B. AGING MANAGEMENT PROGRAMS AND ACTIVITIES

The Fermi 2 license renewal application (Reference B.3-1) and information in subsequent related correspondence provided sufficient basis for the NRC to make the findings required by 10 CFR 54.29 (Reference B.3-2). As required by 10 CFR 54.21(d), this UFSAR supplement contains a summary description of the programs and activities for managing the effects of aging (Section B.1) and a description of the evaluation of time-limited aging analyses for the period of extended operation (Section B.2). The period of extended operation is the 20 years after the expiration date of the original operating license for Fermi 2.

B.1 AGING MANAGEMENT PROGRAMS

The integrated plant assessment for license renewal identified aging management programs necessary to provide reasonable assurance that components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis (CLB) for the period of extended operation. This section describes the aging management programs and activities required during the period of extended operation.

Aging management programs will be implemented prior to entering the period of extended operation. For programs requiring enhancements, the programs are described as including the features that will be in place when the enhancements are fully implemented. Each description lists the enhancements required for the program as it existed when the license renewal application was submitted.

Conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment and nonconformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the condition is determined and that corrective action is taken to preclude recurrence. In addition, the identification and cause of the significant condition adverse to quality and the corrective action implemented is documented and reported to appropriate levels of management. The corrective action controls of the Fermi 2 Quality Assurance Program (10 CFR Part 50, Appendix B) are applicable to all aging management programs and activities required during the period of extended operation.

Corrective actions for systems, structures and components are accomplished per the existing Fermi 2 Corrective Action Program and Fermi 2 procedures. The site Corrective Action Program and procedure control program apply to license renewal aging management activities for both safety-related and nonsafety-related structures and components.

The confirmation process is part of the Corrective Action Program and includes the following:

- Reviews to assure that proposed actions are adequate for conditions adverse to quality.
- Tracking and reporting of open corrective actions.
- Review of corrective action effectiveness for significant conditions adverse to quality.

If the confirmation process leads to a corrective action requiring inspection or testing, the corrective action will be documented in accordance with the Corrective Action Program. The Corrective Action Program constitutes the confirmation process for the Fermi 2 aging management programs and activities.

Fermi 2 quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR 50, Appendix B. The Fermi 2 QA Program applies to safety-related structures and components. The phrase "Administrative Controls" refers to the adherence to the policies, directives, and procedures and includes the formal review and approval process that procedures and manuals undergo as they are issued and subsequently revised. The Fermi 2 QA Program aspects related to procedure controls and administrative controls (document control requirements for procedures and manuals) and retention of records apply to Fermi 2 aging management activities associated with license renewal for both safety-related and nonsafety-related structures, systems, and components.

The Operating Experience program (OEP) at Fermi 2 and the Corrective Action Program help to assure continued effectiveness of aging management programs through evaluations of operating experience. The OEP implements the requirements of NRC NUREG-0737, *Clarification of TMI Action Plan Requirements*, Section l.C.5, and evaluates site and industry operating experience for impact on Fermi 2. The Corrective Action Program implements the requirements of 10 CFR 50, Appendix B, Criterion XVI and is used to evaluate and effect appropriate actions in response to operating experience relevant to Fermi 2 that indicates a condition adverse to quality or a nonconformance.

Revisions to NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, and other NRC guidance documents on aging management are considered sources of operating experience.

The operating experience program interfaces with and relies on active participation in the Institute of Nuclear Power Operations' operating experience program, as endorsed by the NRC.

In accordance with procedure, incoming operating experience items are screened to identify items that may involve age-related degradation or impact to aging management programs (AMPs), including programs being developed. Items so identified are further evaluated, and AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through these evaluations that the effects of aging may not be adequately managed.

Plant-specific operating experience associated with aging management and age-related degradation is reported to the industry in accordance with guidelines established in the operating experience program.

DTE will make the following changes to the process for operating experience review (OER).

- Procedures will be revised to add an aging type code to Corrective Action Program documents that describe either plant conditions related to aging or industry operating experience related to aging.
- Procedures will be revised to provide for training of personnel responsible for submitting, screening, assigning, evaluating, or otherwise processing plant-specific and industry operating experience concerning age-related degradation and aging

management, as well as for personnel responsible for implementing AMPs, based on the complexity of the job performance requirements and assigned responsibilities.

- Procedures will be revised to specify that evaluations of operating experience concerning age-related degradation will include consideration of the affected systems, structures or components, the environments, materials, aging effects, aging mechanisms, and aging management programs.

DTE currently performs periodic self-assessments on many aging management programs. DTE will enhance the Fermi 2 self-assessment process to provide for periodic evaluation of the effectiveness of each aging management program described in the UFSAR supplement. For new aging management programs, the first evaluation will be performed within five years of implementing the program.

B.1.1 ABOVEGROUND METALLIC TANKS PROGRAM

The Aboveground Metallic Tanks Program is a new program that will manage loss of material and cracking for outdoor tanks within the scope of license renewal that are sited on soil or concrete. Preventive measures to mitigate corrosion and cracking were applied during construction, such as using the appropriate materials, protective coatings, and elevation as specified in design and installation specifications. For the painted carbon steel combustion turbine generator (CTG) fuel oil tank, the program will monitor the external surface condition for indications and precursors of loss of material. For the insulated aluminum condensate storage tank (CST), the program will monitor the condition of a representative sample of the tank external surface for signs of loss of material, using visual inspections and surface examinations. Exterior portions of the tanks will be inspected in accordance with Table 4a, "Tank Inspection Recommendations," identified in LR-ISG-2012-02. There are no indoor tanks included in this program.

CST internal inspections will be conducted in accordance with Table 4a, identified above. Internal inspections of the CTG fuel oil tank will be conducted in accordance with NUREG-1801, XI.M30.

This program will also manage the bottom surfaces of both in-scope aboveground metallic tanks, which are on concrete ring foundations and sand. The program will require ultrasonic testing (UT) of the tank bottoms to assess the thickness against the thickness specified in the design specification. UT of the tank bottoms will be performed whenever the tanks are drained or at intervals not less than those recommended in Table 4a during the period of extended operation. Caulking or sealant at the concrete/tank interfaces is not credited in the installation and design specifications.

Within the ten years prior to the period of extended operation and every ten years thereafter, a volumetric examination of a minimum 25% of the CST tank bottom interface with the concrete ring foundation will be performed to manage loss of material. The volumetric inspection will be on a 2” grid or less, depending on the technology utilized.

This program will be implemented prior to the period of extended operation, with initial inspections within the ten years prior to the period of extended operation.

B.1.2 BOLTING INTEGRITY PROGRAM

The Bolting Integrity Program manages loss of preload, cracking, and loss of material for closure bolting for safety-related and nonsafety-related pressure-retaining components using preventive and inspection activities. This program does not include the reactor head closure studs or structural bolting. Preventive measures include material selection (e.g., use of materials with an actual yield strength of less than 150 kilo-pounds per square inch [ksi]), lubricant selection (e.g., restricting the use of molybdenum disulfide), applying the appropriate preload (torque), and checking for uniformity of gasket compression where appropriate to preclude loss of preload, loss of material, and cracking. This program supplements the inspection activities required by ASME Section XI for ASME Class 1, 2, and 3 bolting. For ASME Class 1, 2, and 3 bolting and non-ASME Code class bolts, periodic system walkdowns and inspection (at least once per refueling cycle) ensure identification of indications of loss of preload (leakage), cracking, and loss of material before leakage becomes excessive. Identified leaking bolted connections will be monitored at an increased frequency in accordance with the corrective action process. Applicable industry standards and guidance documents, including NUREG-1339, EPRI NP-5769, and EPRI TR-104213, are used to delineate the program.

The Bolting Integrity Program will be enhanced as follows.

- Revise Bolting Integrity Program procedures to perform opportunistic inspections for Control Center HVAC system safety-related pressure-retaining bolting in a lube oil external environment, including the bolting threads to ensure that loss of material in crevice locations that are not readily visible can be detected.
- Revise Bolting Integrity Program procedures to perform opportunistic inspections for CTG system nonsafety-related pressure-retaining bolting in a lube oil external environment.
- Revise Bolting Integrity Program procedures to ensure consideration of actual yield strength when procuring high-strength bolting material. If procured, closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for cracking.
- Revise Bolting Integrity Program procedures to state that bolting for safety-related pressure-retaining components is inspected for leakage, loss of material, cracking, and loss of preload/loss of prestress. Closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for cracking.
- Revise Bolting Integrity Program procedures to (1) implement applicable recommendations for pressure boundary bolting in NUREG-1339, EPRI NP-5769, and EPRI TR-104213; (2) state both ASME Code class bolted connections and non-ASME Code class bolted connections are inspected at least once per refueling cycle; and (3) include volumetric examination per ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, for closure bolting with actual yield strength greater than or equal to 150 ksi regardless of code classification.

- Revise Bolting Integrity Program procedures to inspect RHRSW, EESW, and EDGSW systems' pump and valve bolting submerged in the RHRSW reservoir at least once every refueling outage and to opportunistically inspect bolting threads during maintenance activities.
- Revise Bolting Integrity Program procedures to include the additional guidance and recommendations of EPRI NP-5769 for replacement of ASME pressure-retaining bolts and the guidance provided in EPRI TR-104213 for the replacement of other pressure-retaining bolts.
- Revise Bolting Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.

Enhancements will be implemented prior to the period of extended operation.

B.1.3 BORAFLEX MONITORING PROGRAM

The Boraflex Monitoring Program is an existing program to manage the Boraflex material affixed to the spent fuel storage racks. This program is currently required by Technical Specification 5.5.13 and includes activities implemented in response to NRC GL 96-04 to assure that the required five percent sub-criticality margin is maintained. The Boraflex currently in the spent fuel racks will not be credited for neutron absorption during the period of extended operation and therefore this aging management program will not be relied upon during the period of extended operation. All of the neutron-absorbing material to be credited during the period of extended operation will be managed by the Neutron-Absorbing Material Monitoring Program in Section B.1.27.

B.1.4 BURIED AND UNDERGROUND PIPING PROGRAM

The Buried and Underground Piping Program is a new program that will manage the effects of aging on the external surfaces of buried and underground piping components within the scope of license renewal. The program will manage aging effects of loss of material and cracking for the external surfaces of buried and underground piping fabricated of aluminum, carbon steel, gray cast iron, and stainless steel through preventive and mitigative measures (e.g., coatings, backfill quality, and cathodic protection) and periodic inspection activities during opportunistic or directed excavations. There are no underground or buried tanks for which aging effects would be managed by the Buried and Underground Piping Program. Fermi 2 utilizes a cathodic protection system. Fermi 2 has performed preliminary laboratory soil composition analyses on samples removed from the site to evaluate the potential corrosivity of the soil for use in life cycle management.

Inspections are conducted by qualified individuals. Where the coatings, backfill or the condition of exposed piping does not meet acceptance criteria such that the depth or extent of degradation of the base metal could have resulted in a loss of pressure boundary function when the loss of material rate is extrapolated to the end of the period of extended operation, an increase in the sample size is conducted. Soil testing will be conducted once in each ten-year period starting ten years prior to the period of extended operation, if a reduction in the number of inspections recommended in Table XI.M41-2 of NUREG-1801, is taken based on a lack of soil corrosivity.

When using the 100 mV, -750 mV or -650 polarization criteria as an alternative to the -850 mV criterion, for steel piping, electric resistance probes (ERPs) will be installed in select locations as determined by a Cathodic Protection Specialist. The ERPs will be made of the most anodic metal in the system to ensure adequate protection of the most anodic system metal. Concurrent with the ERPs, permanent reference cells and reference metal will be installed. Installation of the permanent reference cells at pipe depth and near the piping of interest will allow for an accurate measurement of pipe-to-soil potential, minimizing the influence of mixed metals. Where used, the electrical resistance probes will be uncoated and placed in the immediate vicinity of the buried piping it is representing. For each installation application, two probes will be installed; one connected to the cathodic protection system and one left unprotected. The test probe left unprotected (not connected to the pipe) will be free of the mixed metals influence.

This program will be implemented prior to the period of extended operation.

B.1.5 BWR CRD RETURN LINE NOZZLE PROGRAM

The BWR Control Rod Drive (CRD) Return Line Nozzle Program manages cracking of the CRD return line nozzle using preventive, mitigative, and inservice inspection activities, in accordance with Fermi 2 commitments to implement the recommendations in NUREG-0619 and ASME Code Section XI, Subsection IWB, Table IWB 2500-1. Examinations that can detect the presence of cracking are performed to assure detection of cracks before the loss of intended function of the CRD return line nozzle. Cracking found during inservice inspection is evaluated in accordance with ASME Code Section XI requirements. The CRD return line nozzle was capped during construction prior to plant operation.

The BWR CRD Return Line Nozzle Program will be enhanced as follows.

- Revise BWR CRD Return Line Nozzle Program procedures as necessary to ensure that ultrasonic test (UT) examinations will be used to detect applicable aging effects.

Enhancements will be implemented prior to the period of extended operation.

B.1.6 BWR FEEDWATER NOZZLE PROGRAM

The BWR Feedwater Nozzle Program manages cracking of the BWR feedwater nozzles using inspection activities to monitor the effects of cracking due to cyclic loading.

This program augments the examinations specified in the ASME Code, Section XI, with the recommendation and schedule of General Electric NE-523-A71-0594, Revision 1, and NUREG-0619 to perform periodic testing of critical regions of the BWR feedwater nozzles. The feedwater nozzles were never clad and include the improved sparger design. Cracking is evaluated and dispositioned in accordance with the ASME Code.

B.1.7 BWR PENETRATIONS PROGRAM

The BWR Penetrations Program manages cracking due to cyclic loading or stress corrosion cracking (SCC) and intergranular SCC (IGSCC) of BWR instrument penetrations, control rod drive (CRD) housing and incore housing (ICH) penetrations, and standby liquid control (SLC) nozzles/core ΔP nozzles.

Leakage inspections (VT-2) and ultrasonic inspections are scheduled and performed, flaws are evaluated, scope is expanded as required, and acceptance criteria are provided in accordance with the guidelines of the ASME Code Section XI and NRC-approved BWRVIP-49-A, BWRVIP-47-A, and BWRVIP-27-A.

B.1.8 BWR STRESS CORROSION CRACKING PROGRAM

The BWR Stress Corrosion Cracking Program manages intergranular stress corrosion cracking (IGSCC) in stainless steel or nickel alloy reactor coolant pressure boundary piping and piping welds 4 inches or larger in nominal diameter containing reactor coolant at a temperature above 93°C (200°F) during power operation, regardless of code classification.

Scheduled volumetric examinations provide timely detection of IGSCC and leakage of coolant in accordance with the methods, inspection guidelines, and flaw evaluation criteria delineated in the ASME Code; NUREG-0313, Rev. 2; NRC GL 88-01 and its Supplement 1; NRC-approved BWRVIP-75-A; and other requirements specified per 10 CFR 50.55a with NRC-approved alternatives. Ten percent of the feedwater and condensate systems Category D welds are inspected each refueling outage.

The program includes preventive measures such as induction heating stress improvement, solution annealing, and mechanical stress improvement process to minimize stress corrosion cracking.

B.1.9 BWR VESSEL ID ATTACHMENT WELDS PROGRAM

The BWR Vessel ID [inside diameter] Attachment Welds Program manages cracking in structural welds for BWR reactor vessel internal integral attachments using inspections, scheduling, acceptance criteria, and flaw evaluation in conformance with the requirements of ASME Section XI and guidelines of BWRVIP-48-A. The program includes welds between the vessel wall and vessel ID brackets that attach components to the vessel. The internal attachment weld can be a simple weld or a weld build-up pad on the vessel.

B.1.10 BWR VESSEL INTERNALS PROGRAM

The BWR Vessel Internals Program manages cracking, loss of material due to wear, and reduction of fracture toughness for BWR vessel internal components using inspection and flaw evaluation. The program provides (1) determination of the susceptibility of cast austenitic stainless steel components, (2) accounting for the synergistic effect of thermal aging and neutron irradiation, and (3) implementation of a supplemental examination program, as necessary.

Applicable industry standards and NRC-approved BWRVIP documents provide the basis for scheduling inspections to provide timely detection of aging effects, appropriate NDE inspection techniques, acceptance criteria, flaw evaluation, and repair/replacement, as needed. At Fermi 2, management of the reactor vessel internals is implemented in accordance with ASME Section XI and BWRVIP-94, "BWR Vessel and Internals Project, Program Implementation Guide".

The crack growth rate evaluations and fracture toughness values specified in BWRVIP-14-A, BWRVIP-99-A, and BWRVIP-100-A are used for cracked core shroud welds exposed to the neutron fluence values specified in these BWRVIP reports.

This program also addresses aging degradation of CASS and X-750 alloy. Fermi 2 did not use precipitation-hardened (PH) martensitic stainless steel (e.g., 15-5 and 17-4 PH steel) materials and martensitic stainless steel (e.g., 403, 410, 431 steel) in BWR vessel internal components.

The BWR Vessel Internals Program will be enhanced as follows.

- The susceptibility to neutron or thermal embrittlement for reactor vessel internal components composed of CASS and X-750 alloy will be evaluated.
- BWR Vessel Internals Program procedures will be revised as follows. Portions of the susceptible components determined to be limiting from the standpoint of thermal aging susceptibility, neutron fluence, and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions) will be inspected, using an inspection technique capable of detecting the critical flaw size with adequate margin. The critical flaw size will be determined based on the service loading condition and service-degraded material properties. The initial inspection will be performed either prior to or within five years after entering the period of extended operation. If cracking is detected after the initial inspection, the frequency of re-inspection will be justified based on fracture toughness properties appropriate for the condition of the component. The sample size for the initial inspection of susceptible components will be 100 percent of the accessible component population, excluding components that may be in compression during normal operations.
- BWR Vessel Internals Program procedures will be revised as follows. In accordance with an applicant action item for BWRVIP-25 safety evaluation: (a) install core plate wedges prior to the period of extended operation, or (b) complete a plant-specific analysis that justifies no inspections are required, or (c) complete a plant-specific analysis to determine acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25.

  For Option (b), the analysis will address loss of preload due to stress relaxation in the core plate rim hold-down bolts and quantify the loss of preload/stress relaxation that will occur in these bolts during the period of extended operation. The analysis will be submitted to the NRC two years prior to the period of extended operation. Additionally, the UFSAR will be revised to address the analysis if it is determined to meet the criteria for a TLAA at least two years prior to the period of extended operation.

  For Option (c), the analysis will address loss of preload due to stress relaxation in the core plate rim hold-down bolts and quantify the loss of preload/stress relaxation that will occur in these bolts during the period of extended operation. The analysis, inspection plan with acceptance criteria, and justification for the inspection plan will be submitted to the NRC two years prior to the period of extended operation. Additionally, the UFSAR will be revised to address the analysis if it is determined to meet the criteria for a TLAA at least two years prior to the period of extended operation.

- Revise BWR Vessel Internals Program procedures such that the flaw evaluation methodology for the top guide grid beam will address the following three items if they have not been resolved generically during the NRC review and approval process of BWRVIP-183:

  (1) Detected flaws evaluated using the methodology in BWRVIP-183 Section 4 will be demonstrated to be sufficiently far from geometric discontinuities (i.e. notches or slots) such that the stress condition in the vicinity of the flaw is consistent with that for a single edge-crack plate. Appropriately applied K values which account for the effects of geometric discontinuities will be used and justified in the flaw evaluation.

  (2) The flaw evaluation methodology in BWRVIP-183 Section 4 will be used to justify continued operation on a cycle-by-cycle basis. Use of the flaw evaluation methodology to justify operation for more than once cycle will require NRC approval and would be based on plant-specific operating experience including crack length measurements of detected top guide grid beam flaws to benchmark the accuracy of the flaw evaluation methodology.

  (3) When applying the flaw evaluation methodology in BWRVIP-183 Section 4, a severed beam evaluation consistent with BWRVIP-183 Section 5 will also be performed. The severed beam analysis will demonstrate that even if a beam was completely severed beam, it would not be expected to interfere with the ability of the control rod drive system to insert control rods.

- Revise BWR Vessel Internals Program procedures to perform opportunistic inspections of the differential pressure and standby liquid control line inside the reactor vessel when the line becomes accessible.

Enhancements will be implemented prior to the period of extended operation.

B.1.11 COMPRESSED AIR MONITORING PROGRAM

The Compressed Air Monitoring Program manages loss of material in compressed air systems by periodically monitoring air samples for moisture and contaminants and by opportunistically inspecting internal surfaces within compressed air systems. Air quality is maintained in accordance with limits established by considering manufacturer recommendations, as well as recommendations in EPRI NP-7079 and TR 108147, ASME OM-S/G-1998 (Part 17), ANSI standard ISA-S7.0.01-1996, and ISA-S7.3. Inspection frequency, acceptance criteria, and design and operating reviews are performed in accordance with NRC GL 88-14. The program was developed using applicable industry standards and documents such as ISA-S7.3, Quality Standard for Instrument Air, for guidance on preventive measures, inspection of components, and testing and monitoring air quality.

Periodic internal visual inspections of critical components (compressors, dryers, after-coolers, filters, etc.) are performed to detect signs of corrosion. Air quality is monitored and trended to determine if alert levels or limits are being approached or exceeded. Dew point testing and trending is performed quarterly. Particulates, dew points, hydrocarbon content, and corrosive contaminants are monitored.

The Compressed Air Monitoring Program will be enhanced as follows.

- Revise Compressed Air Monitoring Program procedures to periodically sample, test, and monitor moisture and corrosive contaminants to verify parameters are within acceptable limits in the EDG starting air system to mitigate aging effects such as loss of material due to corrosion.
- Revise Compressed Air Monitoring Program procedures to include periodic and opportunistic inspections of accessible internal surfaces of piping, compressors, dryers, aftercoolers, and filters. In addition, include in the Compressed Air Monitoring Program procedures the applicable provisions recommended in EPRI NP 7079, EPRI TR-108147, and ASME OM-S/G-1998, Part 17 for air system contaminants, inspection frequency, inspection methods, and acceptance criteria for components subject to aging management review that are exposed to compressed air in the emergency diesel generator (EDG) starting air system and control air system.

Enhancements will be implemented prior to the period of extended operation.

B.1.12 CONTAINMENT INSERVICE INSPECTION – IWE PROGRAM

The Containment Inservice Inspection (CII) – IWE Program implements the requirements of 10 CFR 50.55a. The regulations in 10 CFR 50.55a impose the inservice inspection (ISI) requirements of the ASME Boiler and Pressure Vessel (B&PV) Code, Section XI, Subsection IWE, for steel containments (Class MC). The Fermi 2 containment design does not include a concrete containment subject to ASME Section XI, Subsection IWL requirements, and therefore the requirements of Class CC are not applicable. There are no tendons associated with Fermi 2's steel containment vessel. The Fermi 2 primary containment is a General Electric Mark I pressure suppression containment and consists of a drywell, a torus (or suppression chamber), and a vent system connecting the drywell and the torus. The scope of the CII-IWE Program includes the steel containment vessel and its integral attachments, containment equipment hatches and airlock and moisture barriers, and pressure-retaining bolting. Visual inspections monitor loss of material of the steel containment vessel surface areas, including welds and base metal and containment vessel integral attachments, metal shell, personnel and equipment access hatches, and pressure-retaining bolting. The CII-IWE Program specifies acceptance criteria, corrective actions, augmented inspections as required and provisions for expansion of the inspection scope when identified degradation exceeds the acceptance criteria. Appendix J, Type A and Type B testing is performed in lieu of surface examinations of dissimilar metal welds of penetration sleeves, penetration bellows, and torus vent line bellows as allowed as an alternative in NUREG-1801, Section XI.S1. The code of record for the examination of the Fermi 2 containment, Class MC components, and related requirements is in accordance with ASME Code Section XI, Subsections IWE, 2001 Edition with the 2003 Addenda, as mandated and modified by 10 CFR 50.55a.

The CII-IWE Program will be enhanced as follows:

- Revise plant procedures to require inspection of the sand cushion drain lines to monitor the internal conditions of the drain lines (e.g. for moisture, sand, blockage) and ensure there is no evidence of blockage at least once prior to the period of extended operation and once every 10 years during the period of extended operation.

- Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting.
- Revise plant procedures to include the preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- Revise plant procedures to determine drywell shell thickness in the sand cushion areas before the period of extended operation and once in each ten year interval during the period of extended operation. From the results (including prior results), develop a corrosion rate to demonstrate that the drywell shell will have sufficient wall thickness to perform its intended function through the period of extended operation.
- Revise plant procedures to require corrective actions should moisture be detected or suspected in the inaccessible area on the exterior of the drywell shell, including:
    - Identify surfaces requiring augmented inspections for the period of extended operation in accordance with Subsection IWE-1240, as identified in Table IWE-2500-1, Examination Category E-C.
    - Use examination methods that are in accordance with Subsection IWE-2500.
    - Demonstrate through use of augmented inspections performed in accordance with Subsection IWE that corrosion is not occurring or that corrosion is progressing so slowly that the degradation will not jeopardize the intended function of the drywell shell through the period of extended operation.

Enhancements will be implemented prior to the period of extended operation.

B.1.13 CONTAINMENT LEAK RATE PROGRAM

The Containment Leak Rate Program consists of tests performed in accordance with the regulations and guidance provided in 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B; Regulatory Guide 1.163, "Performance-Based Containment Leak-Testing Program"; NEI 94-01, "Industry Guideline for Implementing Performance-Based Options of 10 CFR Part 50, Appendix J"; and ANSI/ANS 56.8, "Containment System Leakage Testing Requirements." The Containment Leak Rate Program does not prevent degradation but provides measures for detection of pressure boundary degradation in various systems penetrating containment. Corrective actions are taken if leakage rates exceed acceptance criteria. The program also provides for detection of age-related degradation in material properties of gaskets, O-rings, and packing materials for the containment pressure boundary access points.

Three types of tests are performed under Option B. Type A tests are performed to determine the overall primary containment integrated leakage rate at the loss of coolant accident peak containment pressure. Performance of the integrated leakage rate test per 10 CFR Part 50, Appendix J, Option B, demonstrates the leak-tightness and structural integrity of the containment. Type B and Type C containment local leak rate tests (LLRT), as defined in 10 CFR 50, Appendix J, are intended to detect local leaks and to measure leakage across each pressure-containing or leakage-limiting boundary of containment penetrations. Containment leakage rate tests are performed at frequencies that comply with the requirements of 10 CFR Part 50, Appendix J, Option B.

B.1.14 DIESEL FUEL MONITORING PROGRAM

The Diesel Fuel Monitoring Program manages loss of material in piping, tanks, and other components exposed to an environment of diesel fuel oil by verifying the quality of the fuel oil source. This is accomplished by limiting the quantities of contaminants in diesel fuel oil. Parameters monitored include water, sediment, total particulate, biodiesel concentration, and levels of microbiological activity. Sampling is performed before the fuel oil is allowed to enter the fuel oil storage tanks. The program also requires periodic multi-level sampling of fuel oil storage tanks, where possible. Where multi-level sampling cannot be performed, a representative sample is taken from the lowest part of the tank. If biological activity is identified, biocides are added to prevent biological activity.

Effectiveness of the program is periodically verified by inspecting low flow areas where contaminants may collect, such as in the bottom of tanks. The tanks are periodically sampled, drained, cleaned, and internally inspected for signs of moisture, contaminants and corrosion. Internal tank inspections will be performed at least once during the ten-year period prior to the period of extended operation, and at least once every ten years during the period of extended operation. Where degradation is observed, a wall thickness determination will be made, and the extent of the condition is determined as a part of the Corrective Action Program. Applicable industry standards and guidance documents are used to establish inspection frequency, if not specified by the Fermi 2 Technical Specifications Surveillance Frequency Control Program.

The One-Time Inspection Program describes inspections planned to verify that the Diesel Fuel Monitoring Program has been effective at managing aging effects.

The Diesel Fuel Monitoring Program will be enhanced as follows.

- Revise Diesel Fuel Monitoring Program procedures to monitor and trend water and sediment, particulates, and levels of microbiological organisms in the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and combustion turbine generator (CTG) fuel oil tank quarterly. In addition, revise program procedures to state that biocides or corrosion inhibitors may be added as a preventive measure or are added if periodic testing indicates biological activity or evidence of corrosion, respectively.
- Revise the Diesel Fuel Monitoring Program procedures to include a ten-year periodic cleaning and internal visual inspection of the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and CTG fuel oil tank with the following instructions. The cleanings and internal inspections will be performed at least once during the ten-year period prior to the period of extended operation and at succeeding ten-year intervals. If visual inspection is not possible, perform a volumetric

inspection. If evidence of degradation is observed during visual inspection, perform a volumetric examination of the affected area.

The schedule for the Preventive Maintenance (PM) event to perform diesel fire pump fuel oil tank draining, flushing, and inspection will continue at its frequency at the time of the enhancement implementation, until a PM evaluation of results from fuel oil samples and tank inspections indicates that the system will be capable of continuing to perform its function during the period of extended operation with a lower frequency, not less than once per ten-year interval for cleaning and internal visual inspection consistent with NUREG-1801.

Enhancements will be implemented prior to the period of extended operation.

B.1.15 ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRIC COMPONENTS PROGRAM

The Environmental Qualification (EQ) of Electric Components Program implements the requirements of 10 CFR 50.49. As required by 10 CFR 50.49, EQ components are refurbished, replaced, or their qualification is extended prior to reaching the aging limits established in the evaluation. The Fermi 2 EQ Program manages component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. Reanalysis addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met, and the period of time prior to the end of qualified life when the reanalysis will be completed.

In accordance with 10 CFR 54.21(c)(1)(iii), implementation of the EQ Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B.1.16 EXTERNAL SURFACES MONITORING PROGRAM

The External Surfaces Monitoring Program manages aging effects of components fabricated from metallic, elastomeric, and polymeric materials through periodic visual inspection of external surfaces during system inspections and walkdowns for evidence of leakage, loss of material (including loss of material due to wear), cracking, fouling, and change in material properties. When appropriate for the component and material, physical manipulation, such as touching, pressing, flexing, and bending, is used to augment visual inspections to confirm the absence of hardening and loss of strength in non-metallic materials. The External Surfaces Monitoring Program is also credited for situations where the material and environment combinations are the same for the internal and external surfaces such that the external surfaces are representative of the internal surfaces.

Inspections are performed at a frequency of at least once per refueling cycle by personnel qualified through plant-specific programs. Deficiencies are documented and evaluated under the Corrective Action Program. Surfaces that are not readily visible during plant operations and refueling outages are inspected when they are made accessible and at such intervals that would ensure the components' intended functions are maintained. Inspections of insulated components where the insulation is required to reduce heat transfer will be performed to ensure insulation degradation due to moisture intrusion has not occurred.

Where visual inspection for leakage may not effectively detect cracking in gas-filled stainless steel and aluminum components exposed to outdoor air, alternate detection methods (e.g. performance monitoring or use of a soap solution with the component pressurized) will be employed.

Periodic representative surface condition inspections of the in-scope mechanical indoor components under insulation (with process fluid temperature below the dew point) and outdoor components under insulation will be performed.

For polymeric materials, the visual inspection will include 100 percent of the accessible components. The sample size of polymeric components that receive physical manipulation is at least 10 percent of the available surface area.

Acceptance criteria are defined to ensure that the need for corrective action is identified before a loss of intended function. For stainless steel, a clean shiny surface is expected. For flexible polymers, a uniform surface texture (no cracks) and no change in material properties (e.g., hardness, flexibility, physical dimensions, color unchanged from when the material was new) are expected. For rigid polymers, no surface changes affecting performance, such as erosion, cracking, crazing, checking, and chalking, are acceptable. For insulation, no discoloration, staining, or surface irregularities from moisture intrusion is expected.

The External Surfaces Monitoring Program will be enhanced as follows.

- Revise External Surfaces Monitoring Program procedures to clarify that periodic inspections will be performed of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(2).
- Revise External Surfaces Monitoring Program procedures to inspect 100 percent of accessible components at least once per refueling cycle and to ensure required walkdowns include instructions to inspect for the following related to metallic components:
    - Corrosion (loss of material).
    - Leakage from or onto external surfaces (loss of material).
    - Worn, flaking, or oxide-coated surfaces (loss of material).
    - Corrosion stains on thermal insulation (loss of material).
    - Protective coating degradation (cracking, flaking, and blistering).
    - Leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides (cracking).
- Revise External Surfaces Monitoring Program procedures to include instructions for monitoring aging effects for flexible polymeric components through physical

manipulations of the material, with a sample size for manipulation of at least ten percent of the available surface area. Inspect accessible surfaces for the following:

- Surface cracking, crazing, scuffing, dimensional changes (e.g., ballooning and necking).
- Discoloration.
- Exposure of internal reinforcement for reinforced elastomers.
- Hardening as evidence by loss of suppleness during manipulation where the component and material are appropriate to manipulation.
- Shrinkage, loss of strength.

- Revise External Surfaces Monitoring Program procedures to specify the following for insulated components:
  - Periodic representative inspections will be conducted during each 10-year period.
  - For a representative sample of insulated indoor components exposed to condensation (because the component is operated below the dew point) and insulated outdoor components, insulation will be removed for visual inspection of the component surface. Inspections include a minimum of 20 percent of the in-scope piping length for each material type (e.g., steel, stainless steel, copper alloy, aluminum), or for components with a configuration which does not conform to a 1-foot axial length determination (e.g., valve, accumulator), 20 percent of the surface area. Alternatively, insulation will be removed and a minimum of 25 inspections performed that can be a combination of 1 foot axial length sections and individual components for each material type.
  - Inspection locations are based on the likelihood of corrosion under insulation (CUI). For example, CUI is more likely for components experiencing alternate wetting and drying in environments where trace contaminants could be present and for components that operate for long periods of time below the dew point. Subsequent inspections will consist of an examination of the exterior surface of the insulation for indications of damage to the jacketing or protective outer layer of the insulation, if the following conditions are verified in the initial inspection:
    - No loss of material due to general, pitting or crevice corrosion, beyond that which could have been present during initial construction, and
    - No evidence of cracking.

    If the external visual inspections of the insulation reveal damage to the exterior surface of the insulation or there is evidence of water intrusion through the insulation (e.g. water seepage through insulation seams/joints), periodic inspections under the insulation will continue as described above.
  - Removal of tightly adhering insulation that is impermeable to moisture is not required unless there is evidence of damage to the moisture barrier. If the moisture barrier is intact, the likelihood of CUI is low for tightly adhering insulation. Tightly adhering insulation is considered to be a separate population from the remainder of insulation installed on in-scope components. The entire

population of in-scope accessible piping component surfaces that have tightly adhering insulation will be visually inspected for damage to the moisture barrier with the same frequency as for other types of insulation inspections. These inspections will not be credited towards the inspection quantities for other types of insulation.

- Revise External Surfaces Monitoring Program procedures to include acceptance criteria for the parameters observed.
  - Metals should not have any indications of relevant degradation.
  - Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color.
  - Rigid polymers should have no erosion, cracking, crazing, or chalking.
  - For insulation, no discoloration, staining, or surface irregularities from moisture intrusion.
- Revise External Surfaces Monitoring Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.
- Revise External Surfaces Monitoring Program procedures to include instructions for detection of cracking of gas-filled stainless steel and aluminum components exposed to outdoor air.
- Revise External Surfaces Monitoring Program procedures to:
  a) Visually inspect jacketed and non-jacketed insulation required to reduce heat transfer at a frequency consistent with NUREG-1801 Section XI.M36, as modified by LR-ISG-2012-02, to ensure that insulation degradation due to moisture intrusion has not occurred.
  b) Ensure procedures include instructions to inspect for signs of water intrusion. Inspect accessible surfaces for the following signs of water intrusion: discoloration, staining, or surface irregularities.

Enhancements will be implemented prior to the period of extended operation.

B.1.17 FATIGUE MONITORING PROGRAM

The Fatigue Monitoring Program ensures that fatigue usage remains within allowable limits for components identified to have a TLAA by (a) tracking the number of critical thermal and pressure transients for selected components, (b) verifying that the severity of monitored transients are bounded by the design transient definitions for which they are classified, (c) assessing the impact of the reactor coolant environment on a set of sample critical components including those from NUREG/CR-6260 and those components identified to be more limiting than the components specified in NUREG/CR-6260, and (d) addressing applicable fatigue exemptions. Tracking the number of critical thermal and pressure transients for the selected components ensures a code design usage factor of less than or equal to 1, including environmental effects where applicable. The environmental effects on fatigue for the identified critical components will be evaluated.

The program monitors the number of occurrences for the plant transients that cause significant fatigue usage. The program also provides for updates of fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified.

As an alternative to monitoring occurrences of transients, NUREG-1801, Section X.M1, Fatigue Monitoring, also allows more detailed monitoring of local pressure and thermal conditions to be performed to allow the actual fatigue usage for the specified critical locations to be calculated. Therefore the program will include Stress-Based Fatigue (SBF) monitoring. SBF monitoring computes stress history for a given component from transient pressure and temperature data collected from plant instruments, and the corresponding stress history at the critical location in the component. The stress history is analyzed to identify stress cycles and then a cumulative usage factor is computed. The recommendations of NRC Regulatory Issue Summary (RIS) 2008-30 will be applied for any use of SBF. Use of SBF monitoring will appropriately account for environmental effects on fatigue usage.

The Fatigue Monitoring Program will be enhanced as follows.

- Revise Fatigue Monitoring Program procedures to monitor and track critical thermal and pressure transients for components that have been identified to have a fatigue TLAA.
- Develop environmentally assisted fatigue (EAF) usage calculations that consider the effects of the reactor water environment for a set of sample reactor coolant system components. This sample set will include the locations identified in NUREG/CR-6260 and additional plant-specific component locations in the reactor coolant pressure boundary if they are found more limiting than those considered in NUREG/CR-6260. Environmental correction factors will be determined using formulae consistent with those recommended in NUREG-1801, X.M1.
- Revise Fatigue Monitoring Program procedures to provide updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached, or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified. For components with assumed minimal cycle counts, ensure that exemption assumptions are not exceeded.
- After the EAF calculations are completed, revise the Fatigue Monitoring Program procedures to state that the program counting of the cycle limits maintains the cumulative fatigue usage below the design limit through the period of extended operation, with consideration of the reactor water environmental fatigue effects. Revise Fatigue Monitoring Program procedures to allow for use of cycle-based fatigue (CBF) or stress-based fatigue (SBF) monitoring methods (including environmental effects) if a component's CUF value is projected to exceed 1.0 after EAF calculations are completed.

- Revise Fatigue Monitoring Program procedures so that the scope of the program includes monitoring the operating hours for the main steam bypass operation at the 30%-45% valve open position and perform trending to ensure that the operating time for the main steam bypass operation remains below the design limit during the period of extended operation.
- Revise Fatigue Monitoring Program procedures to provide for corrective actions to prevent the operating time for the main steam bypass from exceeding the analysis during the period of extended operation. Acceptable corrective actions include repair of the component, replacement of the component, or a more rigorous analysis of the component to demonstrate that the service life will not be exceeded during the period of extended operation.

The second enhancement for EAF usage calculations will be implemented at least two years prior to entering the period of extended operation. All other enhancements will be implemented prior to the period of extended operation.

B.1.18 FIRE PROTECTION PROGRAM

The Fire Protection Program manages the following through periodic visual inspection of components and structures with a fire barrier intended function.

- Carbon steel components (loss of material).
- Concrete components (cracking and loss of material).
- Masonry walls (cracking and loss of material).
- Fire resistant materials (loss of material, change in material properties, cracking/delamination, and separation).
- Elastomer components (increased hardness, shrinkage, and loss of strength).

The program includes visual inspections of not less than ten percent of each type of penetration seal at a frequency described in the Technical Requirements Manual (TRM). These inspections examine any sign of degradation, such as cracking, seal separation from walls and components, separation of layers of material, rupture and puncture of seals that are directly caused by increased hardness, and shrinkage of seal material due to loss of material. If any signs of degradation are detected within the sample, the scope of the inspection is expanded to include additional seals.

Visual inspections of the fire barrier walls, ceilings, and floors in structures within the scope of license renewal are performed at a frequency described in the TRM. Inspections of fire barriers include inspections of coatings and wraps. Visual inspection of the fire barrier walls, ceilings, and floors and other fire barrier materials to detect any sign of degradation, such as cracking and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates, are performed to ensure their intended fire protection functions are maintained.

Periodic visual inspections and functional tests are utilized to manage the aging effects of fire doors. Visual inspections of fire door surfaces and functional testing of fire door closing mechanisms and latches are performed at a frequency described in the TRM.

The Fire Protection Program performs visual periodic inspections and functional tests of the CO2 and Halon systems in accordance with the TRM. These actions verify that the systems actuate correctly and that system integrity is maintained by inspecting for conditions of corrosion that could lead to a loss of material.

The Fire Protection Program will be enhanced as follows.

- Revise Fire Protection Program procedures to perform visual inspections to manage loss of material of the Halon and CO2 fire suppression system.
- Revise Fire Protection Program procedures to require visual inspections of in-scope (a) fire wrap and fire stop materials for loss of material, change in material properties, cracking/delamination, separation, increased hardness, shrinkage, and loss of strength; (b) carbon steel penetration sleeves for loss of material; (c) steel framing, roof decking, and floor decking for loss of material; (d) concrete fire barriers including manways, manhole covers, handholes, and roof slabs for loss of material and cracking; and (e) railroad bay airlock doors for loss of material. Inspections are performed at a frequency in accordance with the NRC-approved fire protection program or at least once every refueling cycle.

Enhancements will be implemented prior to the period of extended operation.

B.1.19 FIRE WATER SYSTEM PROGRAM

The Fire Water System Program manages loss of material due to general, pitting, and crevice corrosion, microbiologically influenced corrosion, or fouling, and flow blockage due to fouling for in-scope long-lived passive water-based fire suppression system components using periodic flow testing and visual inspections. When visual inspections are used to detect loss of material, the inspection technique is capable of detecting surface irregularities that could indicate wall loss due to corrosion, corrosion product deposition, and flow blockage due to fouling.

Testing or replacement of sprinkler heads that have been in service for 50 years is performed in accordance with the 2011 Edition of NFPA 25. Portions of the water-based fire water system that a) are normally dry, but periodically subject to flow (e.g., dry-pipe or downstream of deluge valve in a deluge system) and b) cannot be drained or allow water to collect are subject to augmented testing beyond that specified in NFPA 25. These augmented inspections include a) periodic full flow tests at the design pressure and flow rate, or internal inspections, and b) volumetric wall thickness evaluations. Applicable industry standards and guidance documents are also used to delineate the program (e.g., insurance loss control manual and INPO operating experience issuances).

Water system pressure is continuously monitored such that loss of pressure is detected and corrective action initiated.

Program acceptance criteria include (a) the water based fire protection system can maintain required pressure, (b) no unacceptable signs of degradation or fouling are observed during nonintrusive or visual inspections, and (c) in the event surface irregularities are identified, testing is performed to ensure minimum design pipe wall thickness is maintained. The Fire Water System Program will be enhanced as follows.

- Revise Fire Water System Program procedures to ensure sprinkler heads are tested or replaced in accordance with NFPA 25 (2011 Edition), Section 5.3.1.
- Revise Fire Water System Program procedures to perform an inspection of wet fire water system piping condition at least once every five years by opening a flushing connection at the end of one main and by removing a sprinkler toward the end of one branch line for the purpose of inspecting the interior for evidence of loss of material and the presence of foreign organic or inorganic material that could result in flow obstructions or blockage of a sprinkler head. Where multiple wet-pipe systems are in a building, every other system shall be inspected in a five year period. Then, in the next five year period, the remaining systems in that building shall be inspected. Refer to NFPA 25 (2011 Edition) Sections 14.2.1 and 14.2.2) The inspection method used shall be capable of detecting surface irregularities that could indicate wall loss due to corrosion, corrosion product deposition, and flow blockage due to fouling. Ensure procedures require a follow-up volumetric wall thickness evaluation where irregularities are detected.
- Revise Fire Water System Program procedures to ensure a) sprinkler heads are tested or replaced in accordance with NFPA 25 (2011 Edition) Section 5.3.1 and b) the fire protection engineer approves the sprinkler testing laboratory.
- Revise Fire Water System Program procedures to a) specify that in accordance with NFPA Section 13.2.5.2 when there is a 10 percent reduction in full flow pressure when compared to the original acceptance test or previously performed tests, the cause of the reduction shall be identified and corrected as necessary and b) note the time to return to static pressure after performing a main drain test.
- Revise Fire Water System Program procedures to notify the fire protection engineer of test results and deficiencies identified or detected during testing.
- Revise Fire Water System Program procedures to ensure piping is cleaned and sprinklers are replaced if obstructions are identified during internal inspections. Sprinklers loaded with dust may be cleaned using air rather than replaced.
- Revise Fire Water System Program procedures to perform an internal inspection of wet fire water system piping conditions at least once every five years by opening a flushing connection at the end of one main and by removing a sprinkler toward the end of the branch line for the purpose of inspecting the interior for evidence of loss of material and the presence of foreign organic and inorganic material that could result in flow obstructions or blockage of sprinkler heads. Where multiple wet-pipe systems are in a building, every other system shall be inspected in a five year period. Then, in the next five year period, the remaining systems in that building shall be inspected.
- Revise Fire Water System Program procedures to perform at least once every five years either an internal inspection of the dry components downstream of the deluge valves for the hydrogen seal oil unit by removing a sprinkler toward the end of one branch line and inspecting for evidence of loss of material and the presence of foreign organic and inorganic material that could result in flow obstructions or blockage of sprinklers,

<u>or</u>

Revise Fire Water System Program procedures to perform at least once every five years an air or smoke test to verify there is no flow obstruction or blockage of sprinklers.

- Revise Fire Water System Program procedures to perform an inspection of the water distribution piping associated with charcoal filters for loss of material and foreign organic or inorganic material when the charcoal beds are replaced.
- Revise Fire Water System Program procedures to perform an obstruction investigation whenever any of the criteria listed in NFPA Section 14.2.1.3 or 14.3.1 are met.
- Perform a fire water system walkdown of the piping and components that are designed to be dry (e.g., downstream of deluge valves or manual isolations of dry fire water piping), but are periodically wetted, to determine if any piping sections are collecting water and are subject to both of the following augmented inspections:
  - In each five year interval, beginning five years prior to the period of extended operation, either a) conduct a flow test or flush sufficient to detect potential flow blockage, or b) conduct a visual inspection of 100 percent of the internal surface of piping segments that cannot be drained or piping segments that allow water to collect.
  - In each five year interval of the period of extended operation, inspect 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect using volumetric techniques to measure wall thickness. Measurement points will be obtained so that each potential degraded condition can be identified (e.g., general corrosion, MIC). The 20 percent of piping that will be inspected in each five year interval will be in different locations than previously inspected piping.
- Revise Fire Water System Program procedures to include acceptance criteria that any indication of fouling is evaluated.
- Revise Fire Water System Program procedures to specify that if the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material is removed and the source and extent of condition determined, corrected, and the condition entered into the Corrective Action Program.
- Revise Fire Water System Program procedures to replace sprinklers associated with representative tested sprinkler, if the representative test sprinkler fails to meet the test requirements.
- Revise Fire Water System Program procedures to replace any sprinkler that shows signs of corrosion.
- If the decreasing trend in fire water system flow tests is not resolved through the Corrective Action Program prior to the period of extended operation, revise Fire Water System Program procedures to continue performing annual fire water system

flow tests during the period of extended operation until such a time as trend data from fire water system flow tests indicates that the system will be capable of performing its intended function throughout the period of extended operation and therefore TRM frequency may be resumed.

- Revise Fire Water System Program procedures to include formal documentation of the CCHVAC makeup and recirculation fire water supply drain down inspection for indications of flow blockage.

Enhancements will be implemented prior to the period of extended operation.

B.1.20 FLOW-ACCELERATED CORROSION PROGRAM

The Flow-Accelerated Corrosion (FAC) Program manages loss of material due to wall thinning caused by FAC for carbon steel piping and components through (a) performing an analysis to determine systems susceptible to FAC, (b) conducting appropriate analysis to predict wall thinning, (c) performing wall thickness measurements based on wall thinning predictions and operating experience, and (d) evaluating measurement results to determine the remaining service life and the need for replacement or repair of components.

The program also manages wall thinning due to various erosion mechanisms in treated water and steam systems for all materials that may be identified through industry or plant-specific operating experience.

The program relies on implementation of guidelines published by EPRI in NSAC-202L, Rev. 3, and internal and external operating experience. The program uses a predictive code for portions of susceptible systems with design and operating conditions that are amenable to computer modeling. When field measurements identify that the predictive code is not conservative, the model is recalibrated. The model is also adjusted as a result of any power uprates.

A representative sample of components is selected based on the most susceptible locations for wall thickness measurements at a frequency in accordance with NSAC-202L Rev. 3 guidelines to ensure that FAC degradation is identified and mitigated before the component integrity is challenged. Inspections are performed using ultrasonic or other approved testing techniques capable of detecting wall thickness. Measurement results are used to confirm predictions and to plan long-term corrective action. In the event measurements of wall thinning exceed predictions, the extent of the wall thinning is determined as a part of the Corrective Action Program. Components predicted to reach the minimum allowed wall thickness before the next scheduled outage are isolated, repaired, replaced, or reevaluated under the Corrective Action Program.

The FAC Program will be enhanced as follows.

- Revise procedures to indicate that the FAC Program also manages loss of material due to erosion mechanisms of cavitation, flashing, liquid droplet impingement, and solid particle erosion for any material in treated water or steam environments. Include in program procedures a susceptibility review based on internal operating experience; external operating experience; EPRI TR-1011231, Recommendations for Controlling Cavitation, Flashing, Liquid Droplet Impingement, and Solid Particle Erosion in Nuclear Power Plant Piping; and NUREG/CR-6031, Cavitation Guide for

Control Valves. Piping subject to erosive conditions is not excluded from inspections, even if it has been replaced with FAC-resistant material. Periodic wall thickness measurements of such piping should continue until the effectiveness of corrective actions is assured.

- Revise FAC Program procedures to specify that downstream components are monitored for wall thinning when susceptible upstream components are replaced with FAC-resistant materials.

Enhancements will be implemented prior to the period of extended operation.

B.1.21 INSERVICE INSPECTION PROGRAM

The Inservice Inspection (ISI) Program manages loss of material, cracking, and reduction in fracture toughness for ASME Class 1, 2, and 3 pressure-retaining components, including welds, pump casings, valve bodies, integral attachments, and pressure-retaining bolting, using volumetric, surface, and/or visual examination and leakage testing as specified in ASME Code Section XI, 2001 Edition with 2003 Addenda. The examinations, scheduling, acceptance criteria, flaw evaluation, and re-examinations are in accordance with the requirements identified in ASME Section XI with NRC-approved alternatives.

Additional limitations, modifications, and augmentations approved under the provisions of 10 CFR 50.55a with NRC-approved alternatives are included as a part of this program. Every ten years this program is updated to the latest ASME Section XI code edition and addendum approved by the NRC per 10 CFR 50.55a. Repair and replacement activities for these components are covered in Subsection IWA of the ASME code edition of record.

B.1.22 INSERVICE INSPECTION – IWF PROGRAM

The Inservice Inspection (ISI) – IWF Program performs periodic visual examinations of ASME Class 1, 2, 3 and MC piping and component supports to determine general mechanical and structural condition or degradation of component supports such as verification of clearances, settings, physical displacements, loose or missing parts, debris, corrosion, wear, erosion, or the loss of integrity at welded or bolted connections. The ISI-IWF Program is implemented through plant procedures which provide administrative controls, including corrective actions, for the conduct of activities that are necessary to fulfill the requirements of ASME Section XI, as mandated by 10 CFR 50.55a. The monitoring methods are effective in detecting the applicable aging effects, and the frequency of monitoring is adequate to prevent significant degradation.

The ISI-IWF Program will be enhanced as follows.

- Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting.
- Revise plant procedures to require structural bolting replacement and maintenance activities to include appropriate preload and proper tightening (torque or tension) as recommended in EPRI documents, American Society for Testing of Materials

(ASTM) standards, American Institute of Steel Construction (AISC) Specifications, as applicable.

- Revise plant procedures to include the preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- Revise plant procedures to include the preventive action of using bolting material that has an actual measured yield strength less than 150 ksi, except in the case of like-for-like replacement of existing bolting material in the reactor pressure vessel skirt to ring girder bolted joint.
- Revise plant procedures to specify that detection of aging effects will include monitoring anchor bolts for loss of material, loose or missing nuts or bolts, and cracking of concrete around the anchor bolts.
- Revise plant procedures to identify the following unacceptable conditions:
  - Debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces as intended in the design basis of the support.
  - Cracked or sheared bolts, including high-strength bolts, and anchors.
- Revise plant procedures to include assessment of the impact on the inspection sample, in terms of sample size and representativeness, if components that are part of the sample population are re-worked.

Enhancements will be implemented prior to the period of extended operation.

B.1.23 INSPECTION OF OVERHEAD HEAVY LOAD AND LIGHT LOAD (RELATED TO REFUELING) HANDLING SYSTEMS PROGRAM

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (OVHLL) Program performs periodic visual examinations and preventive maintenance to manage loss of material due to corrosion, loose bolting or rivets, and crane rail wear of cranes and hoists, based on industry standards and guidance documents. The program evaluates the effectiveness of the maintenance monitoring program and the effects of past and future usage on the structural reliability of cranes and hoists. The program includes structural components, including structural bolting, that make up the bridge, the trolley, lifting devices, and rails in the rail system and includes cranes and hoists that meet the provisions of 10 CFR 54.4(a)(1) and (a)(2) as well as NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." The activities rely on visual examinations and functional testing to ensure that cranes and hoists are capable of sustaining their rated loads, thus ensuring their intended function is maintained during the period of extended operation.

The Inspection of OVHLL Program will be enhanced as follows.

- Revise plant procedures to specify the monitoring of rails in the rail system for loss of material due to wear; monitor structural components of the bridge, trolley and hoists for deformation, cracking, and loss of material due to corrosion; and monitor structural connections/bolting for loose or missing bolts, nuts, pins or rivets and any other conditions indicative of loss of bolting integrity.

- Revise plant procedures to specify inspection frequency requirements will be in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series.
- Revise plant procedures to require that significant loss of material due to wear of rails in the rail system and any sign of loss of bolting integrity will be evaluated in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series.
- Revise plant procedures to specify that maintenance and repair activities will utilize the guidance provided in ASME B30.2 or other appropriate standard in the ASME B30 series.

Enhancements will be implemented prior to the period of extended operation.

B.1.24 INTERNAL SURFACES IN MISCELLANEOUS PIPING AND DUCTING COMPONENTS PROGRAM

The Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program that will manage fouling, cracking, loss of material, and change in material properties using representative sampling and opportunistic visual inspections of the internal surfaces of piping and components in environments other than open-cycle cooling water, closed treated water, and fire water. Program periodic surveillances or maintenance activities will be conducted when the surfaces are accessible for visual inspection.

Where practical, the inspections will focus on the bounding or lead components most susceptible to aging because of time in service and severity of operating conditions. At a minimum, in each ten-year period during the period of extended operation, a representative sample of 20 percent of the population (defined as components having the same combination of material, environment, and aging effect) or a maximum of 25 components per population will be inspected. Opportunistic inspections will continue in each period despite meeting the sampling limit.

For metallic components, visual inspection of surface conditions will be used to detect evidence of loss of material and fouling. For non-metallic components, visual inspections and physical manipulation or pressurization will be used to detect evidence of surface discontinuities such as cracking and change in material properties. Visual examinations of elastomeric components will be accompanied by physical manipulation such that changes in material properties are readily observable. The sample size for physical manipulation will be at least ten percent of accessible surface area, including visually identified suspect areas.

Specific acceptance criteria will be as follows:

- Stainless steel: clean surfaces, shiny, no abnormal surface condition.
- Metals: no abnormal surface condition.
- Elastomerics: no change in material properties.
- Rigid polymers: no surface changes affecting performance such as erosion and cracking.

Conditions that do not meet the acceptance criteria will be entered into the Corrective Action Program for evaluation. Any indications of relevant degradation will be evaluated using design standards, procedural requirements, current licensing basis, and industry codes or standards.

This program will be implemented prior to the period of extended operation.

B.1.25 MASONRY WALL PROGRAM

The Masonry Wall Program is based on guidance provided in I.E. Bulletin 80-11, "Masonry Wall Design," and Information Notice (IN) 87-67, "Lessons Learned from Regional Inspections of Licensee Actions in Response to I.E. Bulletin 80-11." The scope of the Masonry Wall Program includes masonry walls within the scope of license renewal as delineated in 10 CFR 54.4. The program manages loss of material and cracking of masonry walls so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation. The program will be implemented as part of the Structures Monitoring Program (Section B.1.42).

The program includes visual inspections of masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. Included components are masonry walls required by 10 CFR 50.48, radiation shielding masonry walls, and masonry walls with the potential to affect safety-related components. Structural steel components, steel edge supports, and steel bracing of masonry walls are managed by the Structures Monitoring Program (Section B.1.42).

Enhancements to this program are included in the enhancements to the Structures Monitoring Program (Section B.1.42).

B.1.26 METAL ENCLOSED BUS INSPECTION PROGRAM

The Metal Enclosed Bus Inspection Program is a new condition monitoring program that provides for the inspection of the internal and external portions of metal enclosed bus (MEB) to identify age-related degradation of the bus and bus connections, the bus enclosure assemblies, the bus insulation and the bus insulators. This program will inspect the MEB between combustion turbine generator (CTG) transformer CTG 11-1 and peaker bus 1-2B located in the 120-kV switchyard. The MEB associated with CTG 11-1 is utilized as the alternate AC source for a station blackout (SBO) event and to support response by the Dedicated Shutdown Panel to an Appendix R fire.

The program calls for the visual inspection of MEB internal surface (bus enclosure assemblies) to detect age-related degradation, including cracks, corrosion, foreign debris, excessive dust buildup, and evidence of moisture intrusion. MEB insulating material is visually inspected for signs of reduced insulation resistance due to thermal/thermoxidative degradation of organics/thermoplastics, radiation-induced oxidation, moisture/debris intrusion, or ohmic heating, as indicated by embrittlement, cracking, chipping, melting, swelling, discoloration, or surface contamination, which may indicate overheating or aging degradation. The internal bus insulating supports or insulators will be inspected for structural integrity and signs of cracks. MEB external surfaces are visually inspected for loss of material due to general, pitting, and crevice corrosion. Accessible elastomers (e.g., gaskets, boots, and sealants) are inspected for degradation, including surface cracking, crazing, scuffing, and changes in dimensions (e.g., "ballooning" and "necking"), shrinkage, discoloration, hardening, and loss of strength. A sample of accessible bolted connections will be inspected for increased resistance of connection by using thermography or by measuring connection resistance using a micro-ohmmeter. Torque checking will not be used as an alternative test method. Twenty percent of the population with a maximum sample of 25 will constitute a representative sample size. Otherwise, a technical justification of the methodology and sample size used for selecting components should be included as part of the program's site documentation. These inspections are performed at least once every ten years.

As an alternative to thermography or measuring connection resistance of accessible bolted connections covered with heat shrink tape, sleeving, insulating boots, etc., visual inspection of insulation material may be used to detect surface anomalies, such as embrittlement, cracking, chipping, melting, discoloration, swelling, or surface contamination. When this alternative visual inspection is used to check bolted connections, the first inspection is completed prior to the period of extended operation and every five years thereafter.

This program will be used instead of the Structures Monitoring Program (Section B.1.42) for external surfaces of the bus enclosure assemblies.

This program will be implemented prior to the period of extended operation. This new program will be implemented consistent with the corresponding program described in NUREG-1801, Section XI.E4, Metal-Enclosed Bus.

B.1.27 NEUTRON-ABSORBING MATERIAL MONITORING PROGRAM

The Neutron-Absorbing Material Monitoring Program provides reasonable assurance that degradation of the neutron-absorbing materials (e.g. Boral) used in spent fuel pools that could compromise the criticality analysis will be detected. The program relies on periodic inspection, testing, and other monitoring activities to assure that the required five percent sub-criticality margin is maintained during the period of extended operation. The program monitors loss of material and changes in dimension, such as blisters, pits, and bulges that could result in a loss of neutron-absorbing capability. The parameters monitored include physical measurements and geometric changes in test coupons. The frequency of testing will be based on the condition of the neutron-absorbing material, justified with plant-specific and industry operating experience, prior to the period of extended operation, at a minimum of once every ten years in the period of extended operation. The approach to relating measurement results of the coupons to the spent fuel neutron-absorber materials considers the spent fuel loading strategy. In the event that a loss of neutron-absorbing capacity is anticipated based on coupon testing, additional testing will be performed to ensure the sub-criticality requirements are met.

The Neutron-Absorbing Material Monitoring Program will be enhanced as follows.

- Prior to the period of extended operation, revise Neutron-Absorbing Material Monitoring Program procedures to establish an inspection frequency, justified with plant-specific operating experience, of at least once every ten years, based on the condition of the neutron-absorbing material.
- Revise Neutron-Absorbing Material Monitoring Program procedures to perform trending of coupon testing results to determine the rate of degradation. Ensure the

predicted boron-10 areal density will be sufficient to maintain the subcritical conditions required by technical specifications until the next coupon test.

Enhancements will be implemented prior to the period of extended operation.

B.1.28 NON-EQ CABLE CONNECTIONS PROGRAM

The Non-EQ Cable Connections Program is a new one-time inspection program that consists of a representative sample of electrical connections within the scope of license renewal, which is inspected or tested at least once prior to the period of extended operation to confirm that there are no aging effects requiring management during that period. Cable connections included in this program are those connections susceptible to age-related degradation resulting in increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation that are not subject to the environmental qualification requirements of 10 CFR 50.49. Inspection methods may include thermography, contact resistance testing, or other appropriate testing methods without removing the connection insulation, such as heat shrink tape, sleeving, insulating boots, etc.. Torque checking will not be used as an alternative test method. The one-time inspection provides additional confirmation to support industry operating experience that shows that electrical connections have not experienced a high degree of failures and that existing installation and maintenance practices are effective.

The factors considered for sample selection will be application (medium and low voltage, defined as < 35 kV), circuit loading (high loading), connection type (crimped, bolted, and tap box), and location (high temperature, high humidity, vibration, etc.). The representative sample size will be based on 20 percent of the connection population with a maximum sample of 25. The technical basis for the sample selections will be documented. If an unacceptable condition or situation is identified in the selected sample, the corrective action program will be used to evaluate the condition and determine appropriate corrective action.

The inspections will be performed prior to the period of extended operation.

B.1.29 NON-EQ INACCESSIBLE POWER CABLES (400 V TO 13.8 KV) PROGRAM

The Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program is a new condition monitoring program that will manage the aging effect of reduced insulation resistance on inaccessible power (400 V to 13.8 kV) cables that have a license renewal intended function. The program calls for inaccessible or underground (e.g., in conduit, duct bank, or direct buried) power (greater than or equal to 400 volts) cables exposed to significant moisture, to be tested at least once every six years to provide an indication of the condition of the conductor insulation, with the first tests occurring before the period of extended operation. The specific type of test to be used should be a proven, commercially available test capable of detecting reduced insulation resistance of the cable's insulation system due to wetting or submergence. The applicant can assess the condition of the cable insulation with reasonable confidence using one or more of the following techniques: dielectric loss (dissipation factor/power factor), AC voltage withstand, partial discharge, step voltage, time domain reflectometry, insulation resistance and polarization index, line resonance analysis, or other testing that is state-of-the-art at the time the tests are performed. One or more tests are used to determine the condition of the cables so they will continue to meet their intended function during the period of extended operation.

The program will include periodic inspections for water accumulation in manholes within the scope of this program. The inspection frequency for water collection is established and performed based on plant-specific operating experience with cable wetting or submergence in manholes (i.e., the inspection is performed periodically based on water accumulation over time and event-driven occurrences such as heavy rain or flooding). The periodic inspection should occur at least annually. The inspection should include direct observation that cables are not wetted or submerged, that cables/splices and cable support structures are intact, and dewatering/drainage systems (i.e., sump pumps) and associated alarms operate properly. In addition, operation of dewatering devices should be inspected and operation verified prior to any known or predicted heavy rain or flooding.

This program will be implemented prior to the period of extended operation.

B.1.30 NON-EQ INSTRUMENTATION CIRCUITS TEST REVIEW PROGRAM

The Non-EQ Instrumentation Circuits Test Review Program is a new performance monitoring program that will manage the aging effects of applicable cables in the following systems or sub-systems.

- Neutron monitoring
    - Intermediate range channels (IRMs)
    - Average power range monitors (includes local power range monitors [LPRM] detector strings)
- Process radiation monitoring
    - Control center emergency air inlet radiation monitors
    - Fuel pool ventilation exhaust radiation monitors
    - Main steam line radiation monitors

The Non-EQ Instrumentation Circuits Test Review Program calls for the review of calibration results or findings of surveillance tests on electrical cables and connections used in circuits with sensitive, high-voltage, low-level current signals, such as radiation monitoring and nuclear instrumentation, to provide an indication of the existence of aging effects based on acceptance criteria related to instrumentation circuit performance. By reviewing the results obtained during normal calibration or surveillance, an applicant may detect severe aging degradation prior to the loss of the cable and connection intended function. The review of calibration results or findings of surveillance tests is performed at least once every ten years. In cases where cables are not included as part of calibration or surveillance program testing circuit, a proven cable test (such as insulation resistance tests, time domain reflectometry tests, or other testing judged to be effective in determining cable system insulation condition as justified in the application) is performed. The test frequency is based on engineering evaluation and is at least once every ten years.

For sensitive instrumentation circuit cables that are disconnected during instrument calibrations, testing using a proven method for detecting deterioration for the insulation system (such as insulation resistance tests or time domain reflectometry) will occur at least once every ten years, with the first test occurring before the period of extended operation. Applicable industry standards and guidance documents will be used to delineate the program.

The program will be implemented prior to the period of extended operation.

B.1.31 NON-EQ INSULATED CABLES AND CONNECTIONS PROGRAM

The Non-EQ Insulated Cables and Connections Program is a new condition monitoring program that provides reasonable assurance the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation[1], moisture, and chemical contamination (i.e. bird droppings) can be maintained consistent with the current licensing basis through the period of extended operation.

The program consists of accessible insulated electrical cables and connections installed in adverse localized environments to be visually inspected at least once every ten years for cable jacket and connection insulation surface anomalies, such as embrittlement, discoloration, cracking, melting, swelling, or surface contamination, that could indicate incipient conductor insulation aging degradation from temperature, radiation, or moisture.

An adverse localized environment is a condition in a limited plant area that is significantly more severe than the plant design environment for the cable or connection insulation materials.

This program will be implemented prior to the period of extended operation with the first inspection prior to the period of extended operation.

B.1.32 OIL ANALYSIS PROGRAM

The Oil Analysis Program ensures that loss of material and fouling are not occurring by maintaining the quality of the lubricating oil. The program ensures that contaminants (primarily water and particulates) are within acceptable limits. Testing activities include sampling and analysis of lubricating oil for detrimental contaminants. Testing results indicating the presence of water in oil samples initiate corrective action that may include evaluating for in-leakage.

The One-Time Inspection Program utilizes inspections or non-destructive evaluations of representative samples to verify that the Oil Analysis Program has been effective at managing the aging effects.

The Oil Analysis Program will be enhanced as follows.

- Revise Oil Analysis Program procedures to identify components within the scope of the program.

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[1] Reduced insulation resistance from an environment of radiation and air (oxygen) includes radiolysis, photolysis of organics, or radiation induced oxidation. Photolysis is limited to UV sensitive materials.

- Revise Oil Analysis Program procedures to provide a formalized analysis technique for particulate counting.
- Revise Oil Analysis Program procedures to include the sampling and testing recommendations of equipment manufacturers or industry standards.

Enhancements will be implemented prior to the period of extended operation.

B.1.33 ONE-TIME INSPECTION PROGRAM

The One-Time Inspection Program is a new program that will consist of a one-time inspection of selected components to accomplish the following:

- Verify the effectiveness of an aging management program that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. The aging effects evaluated are loss of material, cracking, and fouling.
- Confirm the insignificance of an aging effect for situations in which additional confirmation is appropriate using inspections that verify degradation is not occurring.
- Trigger additional actions that ensure the intended functions of affected components are maintained during the period of extended operation.

The sample size will be 20 percent of the components in each material-environment-aging effect group up to a maximum of 25 components. Identification of inspection locations will be based on the potential for the aging effect to occur. Examination techniques will use established NDE methods with a demonstrated history of effectiveness in detecting the aging effect of concern, including visual, ultrasonic, and surface techniques. Acceptance criteria will be based on applicable ASME or other appropriate standards, design basis information, or vendor-specified requirements and recommendations. Any indication or relevant condition of degradation detected is evaluated. The need for follow-up examinations will be evaluated based on inspection results.

The One-Time Inspection Program will not be used for structures or components with known age-related degradation mechanisms or if the environment in the period of extended operation is not expected to be equivalent to that in the prior 40 years. In these cases, a periodic plant specific inspection will be performed.

The following table identifies potential inspection methods for specific aging effects.

Parameters Monitored and Inspection Methods for Specific Aging Effects			
Aging Effect	Aging Mechanism	Parameters Monitored	Inspection Methods
Loss of material	Crevice corrosion	Surface condition Wall thickness	Visual (VT-1 or equivalent) and/or volumetric (UT)

Parameters Monitored and Inspection Methods for Specific Aging Effects			
Aging Effect	Aging Mechanism	Parameters Monitored	Inspection Methods
Loss of material	Galvanic corrosion	Surface condition Wall thickness	Visual (VT-3 or equivalent) and/or volumetric (UT)
Loss of material	General corrosion	Surface condition Wall thickness	Visual (VT-3 or equivalent) and/or volumetric (UT)
Loss of material	Microbiologically induced corrosion (MIC)	Surface condition Wall thickness	Visual (VT-3 or equivalent) and/or volumetric (UT)
Loss of material	Pitting corrosion	Surface condition Wall thickness	Visual (VT-1 or equivalent) and/or volumetric (UT)
Loss of material	Erosion	Surface condition Wall thickness	Visual (VT-1 or equivalent) and/or volumetric (UT)
Reduction of heat transfer	Fouling	Surface condition	Visual (VT-3 or equivalent)
Cracking	SCC or cyclic loading	Surface condition	Enhanced visual (EVT-1 or equivalent) or surface examination (magnetic particle, liquid penetrant) or volumetric (radiographic testing or UT)

The program will include activities to verify effectiveness of aging management programs and activities to confirm the insignificance of aging effects as described below.

Diesel Fuel Monitoring Program (Section B.1.14)	One-time inspection activity will verify the effectiveness of the Diesel Fuel Monitoring Program by confirming that unacceptable loss of material is not occurring.
Oil Analysis Program (Section B.1.32)	One-time inspection activity will verify the effectiveness of the Oil Analysis Program by confirming that unacceptable loss of material and fouling is not occurring.
Water Chemistry Control – BWR Program (Section B.1.43)	One-time inspection activity will verify the effectiveness of the Water Chemistry Control – BWR Program by confirming that unacceptable cracking, loss of material, and fouling is not occurring.
Stainless steel reactor vessel flange leak off piping and valve body	One-time inspection activity will confirm that cracking is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of core spray piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of residual heat removal (RHR) piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of high pressure coolant injection (HPCI) turbine exhaust piping passing through the waterline region of the suppression pool and HPCI turbine exhaust drain piping to the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.

A representative sample of internal and external surfaces of nuclear pressure relief piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal and external surfaces of reactor core isolation cooling (RCIC) piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of internal surfaces of the normally dry suppression chamber spray piping that is periodically wetted by RHR system testing	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A sample of 25 one-foot long locations of the mechanical draft cooling towers galvanized spray piping will be inspected	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.

Inspections will be performed within the ten years prior to the period of extended operation.

B.1.34 ONE-TIME INSPECTION – SMALL-BORE PIPING PROGRAM

The One-Time Inspection – Small-Bore Piping Program is a new program that will augment ASME Code, Section XI (2001 Edition with 2003 Addenda) requirements and be applicable to small-bore ASME Code Class 1 piping and components with a nominal pipe size diameter less than four inches (NPS 4) and greater than or equal to one inch (NPS 1) in systems that have not experienced cracking of ASME Code Class 1 small-bore piping. Fermi 2 has not experienced cracking of ASME Code Class 1 small-bore piping less than NPS 4 and greater than or equal to NPS 1 due to stress corrosion, cyclical (including thermal, mechanical, and vibration fatigue) loading, or thermal stratification and thermal turbulence. The program can also be used for systems that have experienced cracking but have implemented design changes to effectively mitigate cracking.

This program will provide a one-time volumetric or (socket welds only) opportunistic destructive inspection of ASME Class 1 piping butt weld locations and socket weld locations that are susceptible to cracking. Volumetric examinations will be performed using a demonstrated technique that is capable of detecting the aging effect of cracking in the volume of interest. In the event the opportunity arises to perform a destructive examination of an ASME Class 1 small-bore socket weld that meets the susceptibility criteria, then the program will take credit for two volumetric examinations. The program will include pipes, fittings, branch connections, and full and partial penetration welds.

This program will include a sampling approach. Sample selection will be based on susceptibility to stress corrosion, cyclic loading (including thermal, mechanical, and vibration fatigue), thermal stratification and thermal turbulence, and failure history. Since Fermi 2 will not have more than 30 years of operation at the time of submitting the license renewal application, the inspections include ten percent of the weld population or a maximum of 25 welds of each weld type (e.g., full penetration and socket weld).

The program will include measures to verify that degradation is not occurring, thereby either confirming that there is no need to manage aging-related degradation or validating the effectiveness of any existing program for the period of extended operation. If evidence of cracking is revealed by this one-time inspection, it will be entered into the Corrective Action Program to determine extent of condition, and a follow-up periodic inspection will be managed by a plant-specific program. Flaws or indications are evaluated in accordance with the ASME Code.

The inspection will be performed within the six-year period prior to the period of extended operation.

B.1.35 PERIODIC SURVEILLANCE AND PREVENTIVE MAINTENANCE PROGRAM

There is no corresponding NUREG-1801 program.

The Periodic Surveillance and Preventive Maintenance Program manages aging effects not managed by other aging management programs, including loss of material, fouling, loss of material due to wear, and loss of sealing. Any indication or relevant condition of degradation detected is evaluated. Inspections occur at least once every five years during the period of extended operation.

The Periodic Surveillance and Preventive Maintenance Program also manages loss of material in carbon steel components exposed to raw water due to the recurring internal corrosion aging mechanism collectively referred to as multiple corrosion mechanisms (MCM). MCM was identified as a recurring internal corrosion aging mechanism (RICAM) in an operating experience review conducted by DTE in accordance with LR-ISG-2012-02 Section A.

The Fermi 2 aging management review credits the following inspection activities.

- Visually inspect and manually flex the rubber gasket/seal for reactor building spent fuel storage pool gates to verify no loss of sealing.
- Inspect suppression chamber spray nozzles for flow blockage using an air test.
- Determine wall thickness of selected service water system piping components to manage loss of material due to recurring internal corrosion by multiple corrosion mechanisms.
- Perform advanced eddy current testing on a representative sample of emergency diesel generator (EDG) system air coolant, lube oil, and jacket water heat exchanger

tubes to manage loss of material due to wear and potential stress corrosion induced circumferential cracking.

- Determine wall thickness of selected EDG system piping components to manage loss of material due to recurring internal corrosion by multiple corrosion mechanisms.
- Use visual or other NDE techniques to inspect internal surfaces to manage fouling of the fire water system heat exchanger tubes exposed to raw water.
- Visually inspect a representative sample of the dry piping downstream of the manual isolation valve for the cable spreading room wet pipe system for flow blockage. The first inspection will be within five years of the period of extended operation.
- Visually inspect a representative sample of combustion turbine generator (CTG) system lube oil heat exchanger tubes to manage loss of material due to wear.
- Visually inspect a representative sample of CTG system atomizing air precooler heat exchanger tubes to manage fouling and loss of material due to wear.
- Visually inspect and clean CTG system atomizing air booster compressor suction filter to manage fouling.
- Visually inspect and clean CTG system compressor extraction air filter to manage fouling.
- Use visual or other NDE techniques to inspect a sample of the containment atmospheric control system recombiner components' internal surfaces to manage loss of material. The area sampled may be outside the recombiner housing.
- Perform thermography on a sample of non-jacketed insulation having an intended function of "insulation" to assess its insulating ability. A sample will consist of at least 20 percent of the available population of non-jacketed insulation where the insulated piping has a heat load and is not located in a high radiation area. The first thermography will be during the five years prior to the period of extended operation.
- Nonsafety-related systems, structures, and components affecting safety-related systems, structures, and components.
  - Visually inspect the internal surface of a representative sample of nuclear boiler system (B21) piping and valve bodies to manage loss of material.
  - Determine wall thickness of selected RHR Service Water system (E11) piping components to manage loss of material due to recurring internal corrosion by multiple corrosion mechanisms.
  - Perform visual or ultrasonic inspection of a representative sample of the internal surface of fuel pool cooling and cleanup system (G41) abandoned piping to manage loss of material.
  - Visually inspect the internal surface of a representative sample of condensate system (N20) piping, pump casing, tanks, and valve bodies to manage loss of material.

- Visually inspect the internal surface of a representative sample of heater drains system (N22) piping, thermowells, and valve bodies to manage loss of material.
- Visually inspect the internal surface of a representative sample of main turbine generator and auxiliaries system (N30) piping, tanks, and valve bodies to manage loss of material.
- Visually inspect the internal surface of a representative sample of condenser and auxiliaries system (N61) piping and valve bodies to manage loss of material.
- Visually inspect the internal surface of a representative sample of process sampling system (P33) chiller and cooler housing to manage loss of material.
- Determine wall thickness of selected general service water system (P41) piping components to manage loss of material due to recurring internal corrosion by multiple corrosion mechanisms.
- Determine wall thickness of selected emergency equipment service water system (P45) piping components to manage loss of material due to recurring internal corrosion by multiple corrosion mechanisms.
- Visually inspect the internal surface of a representative sample of drips, drains and vents system (P95) piping and valve bodies to manage loss of material.
- Determine wall thickness of selected EDG system (R30) piping components to manage loss of material due to recurring internal corrosion by multiple corrosion mechanisms.
- Visually inspect the internal surface of a representative sample of reactor/ auxiliary building HVAC system (T41) piping, strainer housing, tubing, and valve bodies to manage loss of material.
- Visually inspect the internal surface of a representative sample of containment atmospheric control system (T48) piping and valve bodies to manage loss of material.

The Periodic Surveillance and Preventive Maintenance Program will be enhanced as follows.

- Revise the Periodic Surveillance and Preventive Maintenance Program procedures as necessary to incorporate the identified activities.
- Revise Periodic Surveillance and Preventive Maintenance Program procedures to require periodic determination of wall thickness for selected piping components.
- Revise Periodic Surveillance and Preventive Maintenance Program procedures to require wall thickness measurements using UT or other suitable techniques at selected locations be periodically performed to identify loss of material due to MCM in system piping components. The selected locations are based on pipe configuration, flow conditions and operating history to represent a cross-section of potential MCM sites. The selected locations are periodically reviewed to validate their relevance and usefulness, and are modified accordingly. Prior to the period of extended operation, select a method (or methods) from available technologies for inspecting internal surfaces of buried piping that provides suitable indication of piping wall thickness for a representative set of buried piping locations.

- Revise Periodic Surveillance and Preventive Maintenance Program procedures to compare wall thickness measurements to nominal wall thickness or previous measurements to determine rates of corrosion degradation. Compare wall thickness measurements to code minimum wall thickness plus margin for corrosion during the refueling cycle (T_{marg}) to determine acceptability of the component for continued use. Perform subsequent wall thickness measurements as needed for each selected location based on the rate of corrosion and expected time to reach T_{marg}. Perform a minimum of five MCM degradation inspections per year until the rate of MCM corrosion occurrences no longer meets the criteria for recurring internal corrosion.
- Revise the Periodic Surveillance and Preventive Maintenance Program procedures to state that the acceptance criterion is no indication of relevant degradation and to incorporate the following:
  - Examples of acceptance criteria for metallic components
    - No excessive corrosion (loss of material).
    - No leakage from or onto internal surfaces (loss of material).
    - No excessive wear (loss of material).
    - No flow blockage due to fouling.
    - No loss of piping component structural integrity.
  - Examples of acceptance criteria for elastomeric components
    - Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color.

Enhancements will be implemented prior to the period of extended operation.

B.1.36 PROTECTIVE COATING MONITORING AND MAINTENANCE PROGRAM

The Protective Coating Monitoring and Maintenance Program monitors and maintains Service Level I coatings applied to carbon steel and concrete surfaces inside containment (e.g., steel containment vessel shell, structural steel, supports, penetrations, and concrete walls and floors). The program addresses accessible coated surfaces inside containment. The Fermi 2 program will be enhanced to meet the technical basis of ASTM D5163-08. With these enhancements, the program provides an effective method to assess coating condition through visual inspections by identifying degraded or damaged coatings and providing a means for repair of identified problem areas.

Service Level I protective coatings are not credited to manage the effects of aging. Proper monitoring and maintenance of protective coatings inside containment ensures operability of post-accident safety systems that rely on water recycled through the containment. The proper monitoring and maintenance of Service Level I coatings ensures there is no coating degradation that would impact safety functions, for example, by clogging emergency core cooling systems suction strainers and possibly causing unacceptable head loss in the system.

The Protective Coating Monitoring and Maintenance Program will be enhanced as follows.

- Revise plant procedures to include in the program Service Level I coating applied to steel and concrete surfaces of the steel containment vessel (e.g., steel containment vessel shell, structural steel, supports, penetrations, and concrete walls and floors).
- Revise plant procedures to include information and instructions for monitoring Service Level I coating systems to be used for the inspection of coatings in accordance with guidelines identified in ASTM D5163-08.
- Revise plant procedures to specify the parameters monitored or inspected in accordance with subparagraph 10.2 of ASTM D5163-08.
- Revise plant procedures to establish the inspection frequency in accordance with paragraph 6 of ASTM D5163-08.
- Revise plant procedures to develop an inspection plan and specify inspection methods to be used as identified in accordance with subparagraph 10.1 of ASTM D5163-08.
- Revise plant procedures to specify that the nuclear coating specialist qualification recommendations and duties be as defined in ASTM D7108. As a minimum, qualification of inspection personnel (protective coating surveillance personnel) who perform these inspections shall be as specified in ASTM D4537.
- Revise plant procedures to specify a protective coatings program owner (inspection coordinator and inspection results evaluator) or equivalent to nuclear coating specialist defined in ASTM D5163-08 is responsible for the overall plant coatings program and has general duties and responsibilities similar to those defined for a nuclear coating specialist in Section 5 of ASTM D7108-05.
- Revise plant procedures to specify that detection of aging effects will include visual inspections of coatings near sumps or screens associated with the emergency core cooling system (ECCS).
- Revise plant procedures to specify instruments and equipment needed for inspection in accordance with subparagraph 10.5 of ASTM D5163-08.
- Revise plant procedures to specify that upon the completion of a planned refuel outage, a coatings outage summary report will be prepared of the coating work performed in Service Level I areas during the outage. The summary report prioritizes repair areas as areas that must be repaired during the same outage or postponed to future outages, keeping the coatings under surveillance during the interim period.
- Revise plant procedures to specify that the last two performance monitoring reports pertaining to the coating systems will be reviewed prior to the inspection or monitoring process.
- Revise plant procedures to describe the characterization, documentation, and testing of defective or deficient coating surface in accordance with subparagraphs 10.2.1 through 10.2.6, 10.3, and 10.4 of ASTM D5163-08.
- Revise plant procedures to specify that the coatings outage summary report will be evaluated and approved by the protective coatings program owner.

Enhancements will be implemented prior to the period of extended operation.

B.1.37 REACTOR HEAD CLOSURE STUDS PROGRAM

The Reactor Head Closure Studs Program manages cracking due to stress corrosion cracking (SCC) or intergranular stress corrosion cracking (IGSCC) and loss of material due to wear or corrosion for reactor head closure stud bolting (studs, washers, nuts, bushings, and threads in flange) using inservice inspection (ASME Section XI 2001 Edition 2003 Addendum Table IWB-2500-1) and preventive measures to mitigate cracking. The program follows examination and inspection requirements to detect and size cracks and detect loss of material. Acceptance criteria and evaluation of indications are in accordance with ASME Section XI and other requirements specified per 10 CFR 50.55a with NRC-approved alternatives.

Preventive actions include avoiding the use of metal-plated stud bolting, use of an acceptable surface treatment, use of stable lubricants, and use of bolting materials with low susceptibility to stress corrosion cracking. The program uses visual, surface, and volumetric examinations as required by ASME Section XI. The program also relies on recommendations to address reactor head closure studs degradation listed in NUREG-1339 and NRC Regulatory Guide (RG) 1.65.

The reactor vessel studs, nuts, closure washers, and threaded bushings at Fermi 2 are fabricated from SA-540 Grade B23 and B24 carbon steel. RG 1.65, October 1973, identifies that SA-540 Grades B23 and B24, when tempered to a maximum tensile strength of 170 ksi, are relatively immune to SCC. Nevertheless, since the actual yield strength is not known, the aging management review conservatively identified the stud material as susceptible to cracking.

The Reactor Head Closure Studs Program will be enhanced as follows.

- Revise Reactor Head Closure Studs Program procedures to ensure that replacement studs are fabricated from bolting material with actual measured yield strength less than 150 kilo-pounds per square inch.
- Revise Reactor Head Closure Studs Program procedures to include a statement that excludes the use of molybdenum disulfide (MoS^2) on the reactor vessel closure studs and also refers to recommendations in RG 1.65, Rev. 1.

Enhancements will be implemented prior to the period of extended operation.

B.1.38 REACTOR VESSEL SURVEILLANCE PROGRAM

The Reactor Vessel Surveillance Program manages reduction of fracture toughness of reactor vessel beltline materials due to neutron irradiation embrittlement and monitors reactor vessel long-term operating conditions that could affect neutron irradiation embrittlement of the reactor vessel using material data and dosimetry. The program includes all reactor vessel beltline materials as defined by 10 CFR 50 Appendix G, Section II.F, and complies with 10 CFR 50, Appendix H for vessel material surveillance.

The objective of the reactor vessel material surveillance program is to provide sufficient material data and dosimetry to (a) monitor irradiation embrittlement at the end of the period of extended operation and (b) determine the need for operating restrictions on the inlet temperature, neutron spectrum, and neutron flux.

The original Fermi 2 reactor vessel surveillance program was designed to monitor reactor vessel beltline materials by testing surveillance capsules withdrawn from the Fermi 2 reactor vessel.

The Fermi 2 reactor vessel surveillance program has been integrated into the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP). The surveillance sample materials remaining in the Fermi 2 reactor pressure vessel (RPV) are maintained as spares for possible future use. The BWRVIP ISP replaces individual plant reactor pressure vessel surveillance capsule programs with representative weld and base materials data from host reactors. Throughout the term of the ISP, the BWRVIP monitors the progress, coordinates future actions such as withdrawal and testing of future capsules and reporting of surveillance capsule test results, and identifies additional program needs. The BWRVIP will identify and implement changes to the program as the need arises. When specific changes are identified to the ISP testing matrix, withdrawal schedule, or testing and reporting of individual capsule results, these modifications will be submitted to the NRC in a timely manner so that appropriate arrangements can be made for implementation.

The integrated surveillance program for the extended period of operation (ISP(E)), based on BWRVIP document BWRVIP-86, Revision 1, has been approved for use by the NRC. BWRVIP 135 provides reactor pressure vessel surveillance data and other technical material information for the plants participating in the ISP and is revised periodically as additional surveillance data is obtained.

B.1.39 RG 1.127, INSPECTION OF WATER-CONTROL STRUCTURES ASSOCIATED WITH NUCLEAR POWER PLANTS PROGRAM

Fermi 2 is not committed to the requirements of NRC Regulatory Guide (RG) 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants." However, the program at Fermi 2 was developed based on guidance provided in the NRC RG 1.127, Revision 1, and provides an inservice inspection and surveillance program for the Fermi 2 shore barrier and raw water-control structures associated with emergency cooling water systems or flood protection. The scope of the Fermi 2 program includes water-control structures within the scope of license renewal as delineated in 10 CFR 54.4. The program performs periodic visual examinations to monitor the condition of water-control structures and structural components, including structural steel and structural bolting associated with water-control structures, and miscellaneous steel associated with these structures. The program addresses age-related deterioration, degradation due to extreme environmental conditions, and the effects of natural phenomena that may affect water-control structures so that the consequences of age-related deterioration and degradation can be prevented or mitigated prior to loss of intended function. The program will be implemented as part of the Structures Monitoring Program (Section B.1.42).

Enhancements to this program are included in the enhancements to the Structures Monitoring Program (Section B.1.42).

B.1.40 SELECTIVE LEACHING PROGRAM

The Selective Leaching Program is a new program that will demonstrate the absence of selective leaching in a selected sample of components (i.e., 20 percent of the population with maximum of 25 components) fabricated from gray cast iron and copper alloys (except for inhibited brass) that contain greater than 15 percent zinc or greater than 8 percent aluminum exposed to raw water, treated water, waste water, or soil. A sample population is defined as components with the same material and environment combination. Where practical, the sample population will focus on bounding or leading components most susceptible to aging due to time in service, severity of operating condition, and lowest design margin. The program will include a one-time visual inspection of selected components coupled with hardness measurement or other mechanical examination techniques such as destructive testing, scraping or chipping to determine whether loss of material is occurring due to selective leaching that may affect the ability of a component to perform its intended function during the period of extended operation.

Follow-up of unacceptable inspection findings will include an evaluation using the Corrective Action Program and possible expansion of the inspection sample size and location.

This inspection will be performed within five years prior to the period of extended operation.

B.1.41 SERVICE WATER INTEGRITY PROGRAM

The Service Water Integrity Program manages loss of material and fouling for safety-related service water system components fabricated from carbon steel, copper alloys, and stainless steel exposed to service water systems as described in the Fermi 2 response to NRC GL 89-13. The program includes (a) surveillance and control techniques to manage effects of biofouling, corrosion, various erosion mechanisms, and silting; (b) tests to verify heat transfer capability of heat exchangers important to safety; (c) routine inspections and maintenance. System walkdowns are performed.

The Service Water Integrity Program will be enhanced as follows.

- Revise Service Water Integrity Program procedures to include inspection to determine if loss of material due to erosion is occurring in the system.
- Revise Service Water Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR 50 Appendix B Quality Assurance Program.

Enhancements will be implemented prior to the period of extended operation.

B.1.42 STRUCTURES MONITORING PROGRAM

The Structures Monitoring Program provides for aging management of structures and structural components, including structural bolting, within the scope of license renewal. The program was developed based on guidance in Regulatory Guide (RG) 1.160, Revision 2, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and NUMARC 93-01, Revision 2, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at

Nuclear Power Plants," to satisfy the requirement of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The scope of the Structures Monitoring Program includes structures within the scope of license renewal as delineated in 10 CFR 54.4. The program performs periodic visual examinations to monitor the condition of structures and structural components, including components such as concrete and steel components, structural bolting, component supports, concrete masonry blocks, and other structures such as earthen structures. Inspections are performed at a frequency to ensure there is no loss of intended function between inspections. The program will be enhanced to perform inspections at least once every five years, with provisions for more frequent inspections, to ensure there is no loss of intended function between inspections. The scope of the program also includes the condition monitoring of masonry walls and water-control structures as described in the Masonry Wall Program and in the NRC RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," aging management.

The Structures Monitoring Program is augmented by plant procedures to ensure that the selection of bolting material, installation torque or tension, and the use of lubricants and sealants are appropriate for the intended purpose. These procedures will be enhanced to include the guidance of NUREG-1339 and EPRI TR-104213, NP-5067, and NP-5769 to ensure proper specification of bolting material, lubricant, and installation torque.

The Structures Monitoring Program will be enhanced as follows.

- Revise plant procedures to add the following structures to the program.
  - Condensate storage tank and condensate return tank foundations and retaining barrier
  - CTG-11-1 fuel oil storage tank foundation
  - Independent spent fuel storage installation (ISFSI) rail transfer pad
  - Manholes, handholes and duct banks
  - Shore barrier
  - Transformer and switchyard support structures and foundations
- Revise plant procedures to specify that the following in-scope structures are included in the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program:
  - General service water pump house
  - Residual heat removal complex
  - Shore barrier
- Revise plant procedures to ensure that masonry walls located in in-scope structures are in the scope of the Masonry Wall Program.
- Revise plant procedures to include a list of structural components and commodities within the scope of license renewal to be monitored in the program.

- Revise plant procedures to include periodic sampling and chemical analysis of ground water.
- Revise plant procedures to include the following preventive actions:
  - Preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize the proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting.
  - Preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- Revise plant procedures to include the following parameters to be monitored or inspected:
  - For concrete structures, base inspections on quantitative requirements of industry codes (i.e., ACI 349.3R-02), standards and guidelines (i.e., ASCE 11) and consideration of industry and plant-specific operating experience.
  - For concrete structures and components, include loss of material, loss of bond, increase in porosity and permeability, loss of strength, and reduction in concrete anchor capacity due to local concrete degradation.
  - For chemical analysis of ground water, monitor pH, chlorides, and sulfates.
  - Monitor gaps between the structural steel supports and masonry walls that could potentially affect wall qualification.
- Revise plant procedures to include the following components to be monitored for the associated parameters:
  - Structural bolting and anchors/fasteners (nuts and bolts) for loss of material, loose or missing nuts and/or bolts, and cracking of concrete around the anchor bolts.
  - Elastomeric vibration isolators and structural sealants for cracking, loss of material, loss of sealing, and change in material properties (e.g., hardening).
- Revise plant procedures to provide technical guidance for torque value requirements for specified bolting material subject to plant operating environments.
- Revise plant procedures to include the following for detection of aging effects:
  - Personnel (Inspection Engineer and Program Administrator or Responsible Engineer) involved with the inspection and evaluation of structures and structural components, including masonry walls and water-control structures, meet the qualifications guidance identified in ACI 349.3R-02.
  - Visual inspection of elastomeric material should be supplemented by feel or touch to detect hardening if performance of the intended function of the elastomeric material is suspect. Include instructions to augment the visual examination of elastomeric material with physical manipulation of at least ten percent of available surface area.
  - Structures will be inspected at least once every five years.

- Submerged structures will be inspected at least once every five years.
- If normally inaccessible areas become accessible due to plant activities, an inspection of these areas shall be conducted. Additionally, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible areas.
- Sampling and chemical analysis of ground water at least once every five years. The Structures Monitoring Program owner will review the results and evaluate any anomalies and perform trending of the results.
- Masonry walls will be inspected at least once every five years, with provisions for more frequent inspections in areas where significant aging effects (i.e., missing blocks, cracking, etc.) is observed to ensure there is no loss of intended function between inspections.
- Inspection of water-control structures should be conducted under the direction of qualified personnel experienced in the investigation, design, construction, and operation of these types of facilities.
- Inspections of water-control structures on an interval not to exceed five years.
- Perform special inspections of water-control structures immediately (within 30 days) following the occurrence of significant natural phenomena, such as large floods, earthquakes, hurricanes, tornadoes, and intense local rainfalls.

- Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R-02and information provided in industry codes, standards, and guidelines including ACI 318, ANSI/ASCE 11, and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria.
- Revise plant procedures to include acceptance criteria for masonry wall inspections that ensure observed aging effects (cracking, loss of material or gaps between the structural steel supports and masonry walls) do not invalidate the wall’s evaluation basis or impact its intended function.
- Revise Structures Monitoring Program procedures to include testing and evaluation of water/mineral deposits where in-leakage is observed in concrete elements. Testing and evaluation will determine whether leaching of calcium hydroxide and carbonation are occurring that could impact the intended function(s) of the concrete structure.
- The following testing and evaluation will be performed prior to the period of extended operation to confirm that previously identified conditions are not the result of leaching of calcium hydroxide and carbonation that could impact the intended function(s) of the concrete structure.
    - Available water/mineral deposit samples will be tested for mineral and iron content to assess the effect of the water in-leakage on the reinforced concrete elements involved.

- The results of the testing and Structures Monitoring Program inspections will be used to determine corrective actions per the Corrective Action Program. Possible corrective actions include, but are not limited to, more frequent inspections, sampling and analysis of the in-leakage water for mineral and iron content, testing core bore samples, and evaluation of the affected area using evaluation and acceptance criteria of ACI 349.3R-02.

Enhancements will be implemented prior to the period of extended operation.

B.1.43 WATER CHEMISTRY CONTROL – BWR PROGRAM

The Water Chemistry Control – BWR Program manages loss of material, cracking, and fouling in components exposed to a treated water environment through periodic monitoring and control of water chemistry. The Water Chemistry Control – BWR Program monitors and controls water chemistry parameters such as pH, chloride, conductivity, and sulfate. EPRI Report 3002002623 is used to provide guidance.

The One-Time Inspection Program utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – BWR Program has been effective at managing aging effects. The representative sample includes low flow and stagnant areas.

B.1.44 WATER CHEMISTRY CONTROL – CLOSED TREATED WATER SYSTEMS PROGRAM

The Water Chemistry Control – Closed Treated Water Systems Program manages loss of material, cracking, and fouling in components exposed to a closed treated water environment, through monitoring and control of water chemistry, including the use of corrosion inhibitors, chemical testing, and visual inspections of internal surface condition. The EPRI Closed Cycle Cooling Guideline (1007820), industry guidance, and vendor recommendations are used to delineate the program.

The Water Chemistry Control – Closed Treated Water Systems Program will be enhanced as follows.

- Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to include the following systems.
    - Process sampling system sample cooler loops
    - CCHVAC chill water system
- Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to provide chemical treatment including a corrosion inhibitor for the following systems in accordance with industry guidelines and vendor recommendations.
    - Process sampling system sample cooler loops
    - CCHVAC chill water system

- Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to specify water chemistry parameters monitored and the acceptable range of values for these parameters in accordance with EPRI 1007820, industry guidance, or vendor recommendations.
- Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to inspect accessible components whenever a closed treated water system boundary is opened. Ensure that a representative sample of piping and components is inspected at a frequency of at least once every ten years. These inspections will be conducted in accordance with applicable ASME Code requirements, industry standards, or other plant-specific inspection guidance by qualified personnel using procedures that are capable of detecting corrosion, fouling, or cracking.

  If visual examination identifies adverse conditions, then additional examinations, including ultrasonic testing, are conducted. Components inspected will be those with the highest likelihood of corrosion, fouling, or cracking. A representative sample is 20 percent of the population (defined as components having the same material, environment, and aging effect combination) with a maximum of 25 components.

  Perform treated water sampling and analysis of the closed treated water systems per industry standards and in no case greater than quarterly unless justified with an additional analysis. The process sampling system sample cooler loops will be sampled and tested annually.

Enhancements will be implemented prior to the period of extended operation.

B.1.45 COATING INTEGRITY PROGRAM

The Coating Integrity Program is a new program that will include periodic visual inspections of coatings/linings applied to the internal surfaces of in-scope piping, piping components, heat exchangers, and tanks where loss of coating or lining integrity could prevent accomplishment of a license renewal intended function. For coatings/linings that do not meet the acceptance criteria, physical testing is performed where possible (i.e., sufficient room to conduct testing) in conjunction with visual inspection. Hand tool cleaning and power tool cleaning will be controlled by site procedures that incorporate standards established by the Society of Protective Coatings (SSPC). Specifically, the standards include SSPC-SP 2 Hand Tool Cleaning, SSPC-SP 3 Power Tool Cleaning, and SSPC-SP 11 Power Tool Cleaning to Bare Metal. Further, where applicable, standards for water-jet cleaning will also be incorporated. These would include SSPC-SP WJ-1, 2, 3, and 4. Although there is not an SSPC standard for tap testing, guidance for tap testing is provided in the EPRI Comprehensive Coatings Training Course. This guidance will also be incorporated into site procedures. The training and qualification of individuals involved in inspections of non-cementitious coatings/linings are in accordance with ASTM standards endorsed in RG 1.54. In addition, the EPRI Comprehensive Coatings Training Course will be incorporated into site training and qualification requirements for a Coating Specialist. For cementitious coatings, training and qualifications are based on an appropriate combination of education and experience related to inspecting concrete surfaces. Service Level 1 coatings are managed by the Protective Coating Monitoring and Maintenance Program (Section B.1.36).

Baseline coating/lining inspections will occur in the 10-year period prior to the period of extended operation. Subsequent inspections are based on an evaluation of the effect of a coating/lining failure on in-scope component intended functions, potential problems identified during prior inspections, and service life history, but should not exceed the inspection intervals in Table 4a “Inspection Intervals for Internal Coatings/Linings for Tanks, Piping, Piping Components, and Heat Exchangers” identified in LR-ISG-2013-01.

B.2 EVALUATION OF TIME-LIMITED AGING ANALYSES

In accordance with 10 CFR 54.21(c), an application for a renewed license requires an evaluation of time-limited aging analyses for the period of extended operation. The following time-limited aging analyses have been identified and evaluated to meet this requirement.

B.2.1 REACTOR VESSEL NEUTRON EMBRITTLEMENT

The reactor vessel neutron embrittlement time-limited aging analyses, including consideration for measurement uncertainty recapture/thermal power optimization (MUR/TPO) (Refs. DTE Electric Company to NRC, "License Amendment Request for Measurement Un, NRC to DTE Electric, "Fermi 2—Issuance of Amendment re: Measurement Uncertainty Re), either have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) or will be managed for the period of extended operation in accordance with 10 CFR 54.24(c)(1)(iii) as summarized below.

Based on the plant operating history, a projected value of 52 EFPY is used to evaluate reactor vessel neutron embrittlement time-limited aging analyses (TLAAs).

B.2.1.1 REACTOR VESSEL FLUENCE

Fluence is calculated based on a time-limited assumption defined by the operating term. Therefore, analyses that evaluate reactor vessel neutron embrittlement based on calculated fluence are time-limited aging analyses.

The reactor vessel fluence has been calculated to include higher power level beginning with cycle 17, when the reactor power increased due to the MUR/TPO uprate. The peak neutron fluence projected for 52 EFPY is 1.43E+18 n/cm^2 at the vessel inner surface. The high energy (> 1 MeV) neutron fluence for the welds and shells of the reactor pressure vessel (RPV) beltline region was determined using the General Electric-Hitachi (GEH) method for neutron flux calculation documented in report NEDC-32983P-A. The method adheres to the guidance prescribed in Regulatory Guide (RG) 1.190.

The neutron fluence calculation results are inputs into fracture toughness analyses. The effects of aging due to neutron irradiation are considered in the neutron embrittlement TLAAs for the reactor vessel (e.g., upper-shelf energy analysis and P-T limits analysis). The neutron fluence analysis has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

B.2.1.2 ADJUSTED REFERENCE TEMPERATURE

A key parameter that characterizes the fracture toughness of a material is the reference nil-ductility transition temperature (RT_{NDT}). The effects of neutron radiation on RT_{NDT} are reflected in the reference temperature change (ΔRT_{NDT}). The adjusted reference temperature (ART) is calculated by adding ΔRT_{NDT} to initial RT_{NDT} with an appropriate margin for uncertainties (ΔRT_{NDT} + RT_{NDT} + margin) as defined by RG 1.99 Revision 2.

The method used for the evaluation of the 52 EFPY ART is the same method used by GEH for the MUR/TPO ART evaluation. The ART values for all beltline materials are calculated using fluence values determined with an NRC-approved method that complies with RG 1.190. All projected values are well below the 200°F suggested in Section C.3 of RG 1.99 as an acceptable nominal value of ART for the end of life. The TLAA for ART has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). Formal revisions of affected analyses are completed as part of the established process for generation of updated P-T operating limits.

B.2.1.3 PRESSURE-TEMPERATURE LIMITS

Appendix G of 10 CFR 50 requires that the reactor vessel remain within established pressure-temperature (P-T) limits during boltup, hydro-test, pressure tests, normal operation, and anticipated operational occurrences. These limits are calculated using materials and fluence data, including data obtained through the Reactor Vessel Surveillance Program (Section B.1.38).

The P-T limit curves will continue to be updated, as required by Appendix G of 10 CFR Part 50, assuring that limits remain valid through the period of extended operation.

The time-limited aging analyses for reactor vessel pressure-temperature limits will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

B.2.1.4 UPPER SHELF ENERGY

Upper-shelf energy (USE) is evaluated for beltline materials. Fracture toughness criteria in 10 CFR 50 Appendix G require that beltline materials maintain USE no less than 50 ft-lb during operation of the reactor. The 52 EFPY USE values for the beltline materials were determined using methods consistent with RG 1.99. The determination used the peak ¼T fluence. The re-sults of the evaluation demonstrate that all beltline material remains above 50 ft-lb throughout the period of extended operation.

The time-limited aging analysis for upper shelf energy has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

B.2.1.5 REACTOR VESSEL CIRCUMFERENTIAL WELD INSPECTION RELIEF

The reactor pressure vessel (RPV) circumferential weld parameters at 52 EFPY will remain within the NRC's (64 EFPY) bounding parameters from the BWRVIP-05 SER. The fact that the values projected to the end of the period of extended operation are less than the 64 EFPY value provided by the NRC leads to the conclusion that the RPV conditional failure probability is less than the conditional failure probability of the NRC analysis. As such, the conditional probability of failure for circumferential welds remains below that determined during the NRC's final safety evaluation of BWRVIP-05.

The reactor vessel circumferential weld inspection relief for the period of extended operation will be submitted to the NRC in accordance with 10 CFR 50.55(a). The effects of aging associated with the time-limited aging analysis for reactor vessel circumferential weld inspection relief will be managed in accordance with 10 CFR 54.21(c)(1)(iii).

B.2.1.6 REACTOR VESSEL AXIAL WELD FAILURE PROBABILITY

The NRC SER for BWRVIP-74-A evaluated the failure frequency of axially oriented welds in BWR reactor vessels. Applicants for license renewal must evaluate axially oriented RPV welds to show that their failure frequency remains below the value calculated in the BWRVIP-74 SER. The SER states that an acceptable way to do this is to show that the mean RT_{NDT} of the limiting axial beltline weld at the end of the period of extended operation is less than the values specified in the SER.

The projected 52 EFPY Fermi 2 mean ART is less than the bounding value shown in the NRC SER for BWRVIP-74. The reactor vessel axial weld TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

B.2.1.7 REACTOR PRESSURE VESSEL CORE REFLOOD THERMAL SHOCK ANALYSIS

General Electric Report NEDO-10029 is referenced in UFSAR Section A.1.2 and Table 1.6-1. NEDO-10029 addressed the concern for brittle fracture of the reactor pressure vessel due to reflood following a postulated loss of coolant accident (LOCA). The thermal shock analysis documented in NEDO-10029 assumed a design basis recirculation line break LOCA followed by a low pressure coolant injection, accounting for the full effects of neutron embrittlement at the end of 40 years. Because this analysis bounded only 40 years of operation, reflood thermal shock of the reactor pressure vessel has been identified as a TLAA for Fermi 2 requiring evaluation for the period of extended operation.

A later analysis of the BWR vessels was developed in 1979 (Ranganath, S., "Fracture Mechanics Evaluation of a Boiling Water Reactor Vessel Following a Postulated Loss of Coolant Accident," Fifth International Conference on Structural Mechanics in Reactor Technology, Berlin, Germany, August 1979 (Accession No. 9110110105 in Public Legacy Library)). The Ranganath analysis has been used to evaluate the TLAA through the period of extended operation. The Ranganath analysis which was performed for a 6-inch thick BWR-6 pressure vessel is bounding for the Fermi 2 vessel. The thickness of the lower shell for the Fermi 2 vessel is 7.125 inches; the thickness of the lower-intermediate shell is 6.125 inches. The Ranganath analysis is bounding for Fermi 2 because (1) the pressure stress (higher for a thinner vessel) is near zero in a thermal shock event and therefore can be neglected, and (2) the difference in temperature and thermal stresses at the ¼T location between a 6-inch thick vessel and a 6.125-inch or 7.125-inch thick vessel (as demonstrated in Figures 3 and 4 of Ranganath) is small. The fluence level and ART values used are specific to Fermi 2, as projected for 52 EFPY. The analysis shows that when the peak stress intensity occurs at approximately 300 seconds after the LOCA, the temperature of the vessel wall at 1.5 inches deep is approximately 400°F.

The maximum ART value calculated for the Fermi 2 RPV beltline material is 102°F. Using the equation for fracture toughness K_{IC} presented in Appendix A of ASME Section XI and the maximum ART value, the material reaches upper shelf at approximately 206°F, which is well below the approximately 400°F temperature predicted for the thermal shock event at the time of peak stress intensity. Therefore, the revised evaluation, using the Ranganath analysis, has projected the TLAA through the period of extended operation. The reactor pressure vessel core reflood thermal shock TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

B.2.2 METAL FATIGUE

B.2.2.1 CLASS 1 METAL FATIGUE ANALYSES

Fatigue evaluations were performed in the design of the Fermi 2 Class 1 components. Class 1 fatigue evaluations are contained in analyses and stress reports, and because they are based on a number of transient cycles assumed for a 40-year operating term, these evaluations are considered time-limited aging analyses.

The Fatigue Monitoring Program (Section B.1.17) tracks transient cycles and requires corrective actions, if the numbers of cycles approach analyzed values. It provides for use of cycle-based fatigue or stress-based fatigue monitoring methods if a component's cumulative usage factor based on cycle counting is projected to exceed 1.0 after the environmentally assisted fatigue (EAF) calculations are complete. The Fatigue Monitoring Program will manage the effects of aging due to fatigue in accordance with 10 CFR 54.21(c)(1)(iii).

The following provides additional information for specific Class 1 components.

Reactor Pressure Vessel

As described in UFSAR Section 5.4.6.3.1 and shown in UFSAR Figure 5.4-1, the RPV is a vertical, cylindrical pressure vessel with hemispherical heads of welded construction. Fatigue evaluations for the reactor vessel were performed as part of the vessel design.

Fermi 2 monitors transient cycles using the Fatigue Monitoring Program (Section B.1.17) and assures that action is taken if the actual cycles approach their analyzed numbers. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the reactor vessel in accordance with 10 CFR 54.21(c)(1)(iii).

Reactor Pressure Vessel Feedwater Nozzle

As described in UFSAR Section 5.2.1.20, Fermi 2 installed a feedwater sparger and thermal sleeve prior to plant operation to eliminate thermal fatigue concerns on the feedwater nozzle. The vessel was manufactured with unclad feedwater nozzles, so no cladding removal was necessary. The inner thermal sleeve is the feed pipe for the sparger and is sealed against the safe-end with a piston ring. The inner thermal sleeve is welded to the sparger forged tee. As described in UFSAR Section 5.2.1.20, the Fermi 2 feedwater sparger and thermal sleeve design conforms to NUREG-0619.

As a part of the NUREG-0619 review, a plant-specific feedwater nozzle fracture mechanics assessment was completed. The projected number of startup/shutdowns plus scrams is less than the total cycles utilized in this analysis. Therefore, the analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The analysis of the feedwater nozzle includes fatigue from potential rapid cycling behind the thermal sleeves. The feedwater nozzle has fatigue usage contribution from rapid cycling that is part of the total fatigue usage for that location. The usage is calculated based on time and feedwater temperature in order to include the rapid cycling effect.

The effects of fatigue on the feedwater nozzles will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

Reactor Pressure Vessel Internals

A reactor vessel general assembly drawing is shown in UFSAR Figure 4.5-1, and a cutaway drawing is shown in UFSAR Figure 5.4-1. The Fermi 2 reactor pressure vessel internals are not ASME code pressure boundary components. ASME analyses were completed for some RVI locations. Fermi 2 will monitor transient cycles using the Fatigue Monitoring Program (Section B.1.17) and assure that action is taken before the numbers of accrued cycles exceed their analyzed numbers. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the reactor vessel internals in accordance with 10 CFR 54.21(c)(1)(iii).

Reactor Recirculation Pumps

As identified in UFSAR Table 3.2-1, the reactor recirculation pumps were designed to the NPVC 1 (NPVC-1, 2, 3 Draft ASME Code for Pumps and Valves for Nuclear Power, Class I, II, III). As identified in Note z of UFSAR Table 3.2-1 and UFSAR Table 3.2-4 Note j, the reactor recirculation pumps were upgraded to the 4th generation design, and the modified components were designed and manufactured to ASME III, 1989. Representative analyses of recirculation pumps are summarized in UFSAR Table 3.9-20.

The Fatigue Monitoring Program (Section B.1.17) will manage the effects of aging due to fatigue on the reactor recirculation pumps in accordance with 10 CFR 54.21(c)(1)(iii).

Class 1 Piping

UFSAR Table 3.2-1 provides a summary of the safety classes for the principal structures, systems, and components of the plant. Components of the reactor coolant pressure boundary whose failure could cause a loss of reactor coolant at a rate in excess of the normal makeup system capability are Class 1 components. Detailed fatigue analyses were generated to analyze multiple locations on each system within the Class 1 boundary.

The Fatigue Monitoring Program (Section B.1.17) will monitor the numbers of cycles incurred to assure that action is taken if the numbers approach the values analyzed. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the Class 1 piping in accordance with 10 CFR 54.21(c)(1)(iii).

B.2.2.2 NON-CLASS 1 METAL FATIGUE ANALYSES

UFSAR Table 3.2-1 provides a summary of the safety classes for the principal structures, systems, and components of the plant. As identified in UFSAR Table 3.2-1, the non-Class 1 piping within the scope of license renewal is built to ASME III or ANSI B31.1.

The design of ASME III Code Class 2 and 3 or ANSI B31.1 piping systems incorporates a stress range reduction factor for piping design with respect to thermal stresses. In general, a stress range reduction factor of 1.0 in the stress analyses applies for up to 7000 thermal cycles. Fermi 2 evaluated the validity of this assumption for 60 years of plant operation. The results of this evaluation indicate that the 7000 thermal cycle assumption will not be exceeded for 60 years of operation. Therefore, the non-Class 1 piping stress calculations are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Non-Class 1 components other than piping require fatigue analyses if they were built to a section of the code such as ASME Section III, NC-3200 or ASME Section VIII, Division 2. A review of the non-Class 1 components identified non-Class 1 fatigue analysis applicable to expansion joints. Fatigue analyses were identified for expansion joints that assumed a bounding number of cycles. These expansion joint fatigue analyses are treated as time-limited aging analyses. Evaluation of these expansion joint analyses determined the number of analyzed cycles was adequate for 60 years of operation. Therefore, these non-Class 1 expansion joint TLAAs are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

B.2.2.3 EFFECTS OF REACTOR WATER ENVIRONMENT ON FATIGUE LIFE

NUREG/CR-6260 addresses the application of environmental correction factors to fatigue analyses (cumulative usage factors [CUFs]) and identifies locations of interest for consideration of environmental effects. NUREG/CR-6260 identified the following component locations to be the most sensitive to environmental effects for General Electric plants.

(1) Reactor vessel shell and lower head

(2) Reactor vessel feedwater nozzle

(3) Reactor recirculation piping (including inlet and outlet nozzles)

(4) Core spray line reactor vessel nozzles and associated Class 1 piping

(5) Residual heat removal nozzles and associated Class 1 piping

(6) Feedwater line Class 1 piping

Environmentally assisted fatigue (EAF) screening was performed for these NUREG/CR-6260 locations and the remaining ASME Class 1 reactor pressure vessel and piping locations for which fatigue had been assessed that are (1) wetted (in contact with liquid reactor coolant) and (2) form part of the reactor coolant pressure boundary. The components with the highest calculated CUF in each system were evaluated for the effects of EAF. The screening evaluation used guidance in NUREG/CR-6909, as allowed by NUREG-1801, Revision 2. The fatigue curves in NUREG/CR-6909 were applied for all materials. The methodology discussed in EPRI 1024995, “Environmentally Assisted Fatigue Screening:

Process and Technical Basis for Identifying EAF Limiting Locations" was used as guidance to determine which locations are bounding. These locations are referred to as Sentinel locations. The Sentinel locations are monitored to manage the effects of aging including EAF in the period of extended operation. This screening has determined there are locations that, when accounting for environmental effects, have projected usage factors greater than 1.0. Additional action will be needed, e.g. more detailed analysis or stress-based or cycle-based fatigue monitoring, as part of the Fatigue Monitoring Program (Section B.1.17) for these locations.

Fermi 2 will manage the effects of fatigue, including environmentally assisted fatigue, under the Fatigue Monitoring Program (Section B.1.17) for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

B.2.3 ENVIRONMENTAL QUALIFICATION OF ELECTRICAL COMPONENTS

All operating plants must meet the requirements of 10 CFR 50.49, which defines the scope of electrical components to be included in a program for qualifying electric equipment important to safety (EQ program) and also sets forth requirements for an EQ program. Qualification is established for the environmental and service conditions expected for normal plant operation and also those conditions postulated for plant accidents. A record of qualification for in-scope components must be prepared and maintained in auditable form. Equipment qualification evaluations for EQ components that result in a qualification of at least 40 years, but less than 60 years, are considered TLAAs for license renewal.

The Fermi 2 Environmental Qualification (EQ) of Electric Components Program (EQ Program) (Section B.1.15) manages component thermal, radiation, and cyclical aging, as applicable, through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the limitations established in the evaluation. The Fermi 2 EQ Program ensures that EQ components are maintained in accordance with their qualification bases.

The Fermi 2 EQ Program is an existing program established to meet Fermi 2 commitments for 10 CFR 50.49. The program is consistent with NUREG-1801, Section X.E1, "Environmental Qualification (EQ) of Electric Components." The Fermi 2 EQ Program will manage the effects of aging on the intended function(s) of EQ components that are the subject of EQ TLAAs for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

B.2.4 FATIGUE OF PRIMARY CONTAINMENT, ATTACHED PIPING, AND COMPONENTS

As described in UFSAR Section 3.8, the primary containment (a Mark I containment) is a leak-tight steel-plate containment vessel consisting of a light-bulb-shaped drywell and a torus-shaped suppression chamber. The Fermi 2 analysis is documented in the Plant Unique Analysis Report (PUAR) for Fermi 2. Fermi 2 will manage the aging effects due to fatigue using the Fatigue Monitoring Program (Section B.1.17) in accordance with 10 CFR 54.21(c)(1)(iii).

The vent line bellows were qualified for bellows expansion from the drywell and torus temperature increase following an accident or from earthquakes. The bellows remain qualified for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Fermi 2 has a refueling bellows attached to the vessel near the reactor vessel flange and a drywell seal bellows outside of the drywell shell. These bellows remain qualified for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Fermi 2 has penetration bellows at the traversing incore probe (TIP) penetrations. The fatigue analysis determined the bellows were qualified for many more cycles than they are expected to experience. Therefore, the bellows remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

As described in UFSAR Section 3.8.2.1.3.1, sleeved penetration assemblies with bellows consist of the process pipe, guard pipe, penetration sleeve bellows, and flued head. For Class 1 piping, the design of the flued head meets ASME III Class 1 requirements, which specify a fatigue analysis that determines the cumulative usage factor for the flued head. Fermi 2 will manage the aging effects due to fatigue of these penetrations using the Fatigue Monitoring Program (Section B.1.17) in accordance with 10 CFR 54.21(c)(1)(iii).

The sleeved penetration assembly bellows were determined to be capable of handling the movement from many more cycles than are projected. The sleeved penetration assembly bellows analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

B.2.5 OTHER PLANT-SPECIFIC TLAAs

B.2.5.1 EROSION OF THE MAIN STEAM LINE FLOW RESTRICTORS

UFSAR Section 5.5.4.4 states that the main steam flow restrictors are fabricated from stainless steel and that only very slow erosion will occur with time. The section later postulates that even with an erosion rate of 0.004 inches per year, the increase in choked flow after 40 years would be no more than 5 percent. Analysis of the erosion rate is evaluated as a TLAA.

DTE Electric evaluated the erosion-corrosion rate for the main steam flow restrictors. This evaluation considered the specific material of the Fermi 2 flow restrictors and determined the expected erosion-corrosion rate when operating at the velocities that would be present following an extended power uprate, which is a greater velocity than anticipated following the MUR/TPO uprate. The evaluation determined that the expected erosion-corrosion rate would be much less than the conservative erosion rate provided in the UFSAR. Assuming the expected erosion-corrosion rate for 60 years of operation, the increase in restrictor-choked flow rate will remain no more than five percent as specified in UFSAR Section 5.5.4.4.

This analysis has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

B.2.5.2 DETERMINATION OF HIGH-ENERGY LINE BREAK LOCATIONS

UFSAR Sections 3.6.1 and 3.6.2 state that the method used to determine the intermediate locations of pipe breaks in high-energy lines includes an evaluation based on CUFs being less than 0.1 if other stress criteria are also met.

Design criteria for piping between the primary containment and outboard isolation valves provide for maximum stresses considering all normal and upset conditions as calculated by the equations in the ASME Boiler & Pressure Vessel Code Section III Paragraph NB-3653. As identified in UFSAR Section 3.6.2.1.2.2, pipe breaks were not postulated in the high energy piping between the containment penetration and outboard isolation valves since the piping was conservatively designed and restrained. The calculated CUFs for containment penetration piping were also limited to values less than 0.1 if equation 10 of NB-3653 exceeds 2.4 S_m.

The CUFs, as calculated in the design fatigue analyses, are based on the design transients assumed for the original 40-year life of the plant; therefore, the CUF analyses used in the selection of postulated high-energy line break locations are considered TLAAs.

The Fatigue Monitoring Program (Section B.1.17) identifies when the transients affecting high-energy piping are approaching their analyzed numbers of cycles.

DTE Electric will manage the effects of aging associated with the fatigue analyses used in the selection of postulated high-energy line break locations using the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

B.2.5.3 JET PUMP AUXILIARY SPRING WEDGE ASSEMBLY

Auxiliary spring wedges have been installed on jet pumps 1, 2 and 15 at Fermi 2 to maintain continuous three point contact for the inlet mixer to the restrainer bracket. A calculation evaluates relaxation of the spring preload for the jet pump auxiliary spring wedge assemblies. The evaluation considers a neutron fluence of 1.2E+20 n/cm^2 (E > 1 MeV) for a 40-year design life. The relaxation of the spring preload in the spring wedge assembly is a TLAA.

To disposition the TLAA, a fluence analysis was performed to determine the fluence values at the three currently installed wedges on the jet pumps and at the bounding location for possible future installation of wedge assemblies through the period of extended operation. The analysis determined that wedge 1 is the limiting case with the projected neutron fluence for wedge 1 slightly exceeding the design fluence prior to the end of the period of extended operation. An evaluation of the slightly higher fluence for wedge 1 determined that it has no impact on the most limiting stresses that were reported in the original stress report. The slightly higher fluence for wedge 1 has no adverse impact on the structural integrity and functional performance.

The results of the analysis demonstrated that the available preload at the end of period of extended operation is considerably greater than the required preload. Additionally, the auxiliary spring wedge assembly is designed to function independent of the spring preload, i.e. the spring wedge function works at any preload. There will be contact between the belly band, auxiliary spring wedge assembly and the restrainer bracket.

This TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

B.2.5.4 JET PUMP SLIP JOINT REPAIR CLAMPS

The jet pump slip joint repair clamp is connected to the diffuser and the mixer. The clamp is installed with a preload that may be relaxed due to neutron fluence. The analysis that evaluated relaxation of the slip joint repair clamp is a TLAA.

To evaluate the TLAA, a fluence analysis including the increased fluence due to the MUR/TPO was performed to determine the fluence at the installed positions on the jet pumps including 52 EFPY. It was determined the neutron irradiation does not impact the amount of expected relaxation. The original relaxation value remains valid for 52 EFPY of operation and the stress report results remain applicable for the period of extended operation.

This TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

B.2.5.5 FLAW EVALUATIONS FOR THE REACTOR VESSEL

During refueling outage 9 (RF9) in 2003, new ASME Section XI, Appendix VIII qualified ultrasonic examination procedures were used for the first time on reactor pressure vessel welds. These new techniques employed greatly improved flaw detection and sizing methods and detected several reactor vessel flaws. A reexamination in RF12 used the phased array technique and identified flaws at two additional locations.

A fracture mechanics evaluation was performed to determine the acceptability of the reactor vessel flaw indications. The analysis evaluated the bounding flaw location for consideration of the pressure-temperature analysis. The analysis determined the indications are acceptable for 52 EFPY with consideration of the effects of MUR/TPO.

This TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

B.2.5.6 MAIN STEAM BYPASS LINES CUMULATIVE OPERATING TIME

A flaw evaluation concluded that the bypass lines are acceptable for safe operation when operated within the 100 day constraint. The cumulative time the main steam bypass lines are operated with the bypass valves between 30 and 45 percent open will be reported annually. A cumulative value of 100 days is not to be exceeded without prior NRC notification.

Fermi 2 will manage the main steam bypass valves' cumulative usage time using the Fatigue Monitoring Program (Section B.1.17) in accordance with 10 CFR 54.21(c)(1)(iii).

B.2.5.7 CRANE (HEAVY LOAD) CYCLES

UFSAR Section 9.1.4.2.2 states that the reactor building overhead crane meets the structural guidelines of Crane Manufacturers Association of America (CMAA) Specification No. 70. CMAA-70 identifies an allowable stress range based on joint category and service class. The definition of service class considers the load class and the load cycles expected on the crane.

The lowest range of cycles in CMAA-70 is 20,000 to 100,000 for Class A cranes; therefore, the analysis associated with the CMAA-70 lift cycle limit is considered a TLAA.

It is estimated that the number of lifts for the reactor building overhead crane will remain below the 100,000 cycles established in CMAA-70 for a Class A service hoist.

Therefore, the evaluation of lift cycles for the reactor building crane remains valid for the period of extended operation consistent with 10 CFR 54.21(c)(1)(i).

REFERENCES

1. DTE Electric Company to NRC, "Fermi 2 License Renewal Application," NRC-14-0028, letter dated April 24, 2014 (ML14121A554).
2. NRC to DTE Electric, "Safety Evaluation Report Related to the License Renewal of Fermi 2 (TAC No. MF4222)," letter dated July 12, 2016 (ML16179A224).
3. DTE Electric Company to NRC, "License Amendment Request for Measurement Uncertainty Recapture (MUR) Power Uprate," NRC-13-0004, letter dated February 7, 2013 (ML13043A659).
4. NRC to DTE Electric, "Fermi 2—Issuance of Amendment re: Measurement Uncertainty Recapture Power Uprate (TAC NO. MF0650)," letter dated February 10, 2014 (ML13364A131).

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
1	DTE will make the following changes to the process for operating experience review. a. Procedures will be revised to add an aging type code to corrective action program documents that describe either plant conditions related to aging or industry operating experience related to aging. b. Procedures will be revised to provide for training of personnel responsible for submitting, screening, assigning, evaluating, or otherwise processing plant-specific and industry operating experience concerning age-related degradation and aging management, as well as for personnel responsible for implementing AMPs, based on the complexity of the job performance requirements and assigned responsibilities. c. Procedures will be revised to specify that evaluations of operating experience concerning age-related degradation will include consideration of the affected systems, structures or components, the environments, materials, aging effects, aging mechanisms, and aging management programs.	A.1	Completed	LRA DTE letter NRC-15-0009 dated 1/15/15 DTE letter NRC-16-0045 dated 7/6/16
2	DTE currently performs periodic self-assessments on many aging management programs. DTE will enhance the Fermi 2 self-assessment process to provide for periodic evaluation of the effectiveness of each aging management program described in the updated final safety analysis report (UFSAR) supplement. For new aging management programs, the first evaluation will be performed within 5 years of implementing the program.	A.1	Within 5 years of implementing the program for new programs.	LRA
3	Implement the new Aboveground Metallic Tanks Program that will manage loss of material and cracking for outdoor tanks within the scope of license renewal that are sited on soil or concrete. Condensate storage tank (CST) internal inspections will be conducted in accordance with Table 4a of LR-ISG-2012-02; internal inspections of the combustion turbine generator (CTG) fuel oil tank will be conducted in accordance with NUREG-1801, XI.M30. This program will also manage the bottom surfaces of both in-scope aboveground metallic tanks. Within the 10 years prior to the period of extended operation and every 10 years	A.1.1	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later. Initial inspections will be performed within the 10 years prior to	LRA DTE letter NRC-15-0005 dated 1/20/15 DTE letter NRC-15-0031 dated 4/10/15

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	thereafter, a volumetric examination of a minimum 25 percent of the CST tank bottom interface with the concrete ring foundation will be performed to manage loss of material. The volumetric inspection will be on a 2 inch grid or less, depending on the technology utilized.		March 20, 2025.	
4	Enhance the Bolting Integrity Program as follows: a. Revise Bolting Integrity Program procedures to ensure consideration of actual yield strength when procuring bolting material. If procured, closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for cracking. b. Revise Bolting Integrity Program procedures to state that bolting for safety-related pressure-retaining components is inspected for leakage, loss of material, cracking, and loss of preload/loss of prestress. Closure bolting with actual yield strength greater than or equal to 150 ksi is monitored for cracking. c. Revise Bolting Integrity Program procedures to: (1) implement applicable recommendations for pressure boundary bolting in NUREG-1339, Electric Power Research Institute (EPRI) NP-5769, and EPRI TR-104213; (2) state both American Society of Mechanical Engineers (ASME) Code class bolted connections and non-ASME Code class bolted connections are inspected at least once per refueling cycle; and (3) include volumetric examination per ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, for closure bolting with actual yield strength greater than or equal to 150 ksi regardless of code classification. d. Revise Bolting Integrity Program procedures to inspect residual heat removal service water (RHRSW), emergency equipment service water (EESW), and emergency diesel generator service water (EDGSW) systems' pump and valve	A.1.2	Prior to September 20, 2024.	LRA DTE letter NRC-15-0006 dated 1/20/15 DTE letter NRC-15-0011 dated 2/12/15

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	bolting submerged in the RHRSW reservoir at least once every refueling outage and to opportunistically inspect bolting threads during maintenance activities. e. Revise Bolting Integrity Program procedures to include the additional guidance and recommendations of EPRI NP-5769 for replacement of ASME pressure-retaining bolts and the guidance provided in EPRI TR-104213 for the replacement of other pressure-retaining bolts. f. Revise Bolting Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR Part 50 Appendix B Quality Assurance Program. g. Revise Bolting Integrity Program procedures to perform opportunistic inspections for Control Center HVAC system safety-related pressure-retaining bolting in a lube oil external environment, including the bolting threads to ensure that loss of material in crevice locations that are not readily visible can be detected. h. Revise Bolting Integrity Program procedures to perform opportunistic inspections for CTG system nonsafety-related pressure-retaining bolting in a lube oil external environment.			
5	Implement the Boraflex rack replacement approved in Amendment No. 141 so that the current Boraflex panels in the spent fuel pool will not be required to perform a neutron absorption function during the period of extended operation.	A.1.3	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA DTE letter NRC-15-0081 dated 9/24/15
6	Implement new Buried and Underground Piping Program that will manage the effects of aging on the external surfaces of buried and underground piping within the scope of license renewal. Soil testing will be conducted once in each 10-year period starting 10 years prior to the period of extended operation, if a reduction in the number of inspections recommended in Table XI.M41-2of NUREG 1801 is taken based on a lack of soil corrosivity.	A.1.4	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later. Initial directed inspections and soil testing (if the	LRA DTE letter NRC-15-0002 dated 1/15/15 DTE Letter

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
			reduction in inspections based on soil testing is taken) will be performed within the 10 years prior to March 20, 2025.	NRC-16-0027 dated 4/12/16
7	Enhance the BWR Vessel Internals Program as follows: a. The susceptibility to neutron or thermal embrittlement for reactor vessel internal components composed of cast austenitic stainless steel (CASS) and X-750 alloy will be evaluated. b. BWR Vessel Internals Program procedures will be revised as follows. Portions of the susceptible components determined to be limiting from the standpoint of thermal aging susceptibility, neutron fluence, and cracking susceptibility (i.e., applied stress, operating temperature, and environmental conditions) will be inspected, using an inspection technique capable of detecting the critical flaw size with adequate margin. The critical flaw size will be determined based on the service loading condition and service-degraded material properties. The initial inspection will be performed either prior to or with-in 5 years after entering the period of extended operation. If cracking is detected after the initial inspection, the frequency of re-inspection will be justified based on fracture toughness properties appropriate for the condition of the component. The sample size for the initial inspection of susceptible components will be 100 percent of the accessible component population, excluding components that may be in compression during normal operations. c. BWR Vessel Internals Program procedures will be revised as follows. In accordance with an applicant action item for BWRVIP-25 safety evaluation: (a) install core plate wedges prior to the period of extended operation, or (b) complete a plant-specific analysis that justifies no inspections are required, or (c) complete a plant-specific analysis to determine	A.1.10	Perform initial inspection either prior to March 20, 2025, or before March 20, 2030. Submit analysis and inspection plan to the NRC prior to March 20, 2023. Remaining activities: Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA DTE letter NRC-15-0010 dated 2/5/15 DTE letter NRC-15-0044 dated 4/27/15 DTE letter NRC-15-0062 dated 6/9/15 DTE letter NRC-15-0083 dated 8/20/15

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	acceptance criteria for continued inspection of core plate hold-down bolts in accordance with BWRVIP-25. For Option (b), the analysis will address loss of preload due to stress relaxation in the core plate rim hold-down bolts and quantify the loss of preload/stress relaxation that will occur in these bolts during the period of extended operation. The analysis will be submitted to the NRC 2 years prior to the period of extended operation. Additionally, the UFSAR will be revised to address the analysis if it is determined to meet the criteria for a time-limited aging analysis (TLAA) at least 2 years prior to the period of extended operation. For Option (c), the analysis will address loss of preload due to stress relaxation in the core plate rim hold-down bolts and quantify the loss of preload/stress relaxation that will occur in these bolts during the period of extended operation. The analysis, inspection plan with acceptance criteria, and justification for the inspection plan will be submitted to the NRC 2 years prior to the period of extended operation. Additionally, the UFSAR will be revised to address the analysis if it is determined to meet the criteria for a TLAA at least 2 years prior to the period of extended operation. d. Revise BWR Vessel Internals Program procedures such that the flaw evaluation methodology for the top guide grid beam will address the following three items if they have not been resolved generically during the NRC review and approval process of BWRVIP-183: (1) Detected flaws evaluated using the methodology in BWRVIP-183 Section 4 will be demonstrated to be sufficiently far from geometric discontinuities (i.e., notches or slots) such that the stress condition in the vicinity of the flaw is consistent with that for a single edgecrack plate. Appropriately applied K values which account for the effects of geometric discontinuities will be used and justified in the flaw evaluation.			

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	(2) The flaw evaluation methodology in BWRVIP-183 Section 4 will be used to justify continued operation on a cycle-by-cycle basis. Use of the flaw evaluation methodology to justify operation for more than once cycle will require NRC approval and would be based on plant-specific operating experience including crack length measurements of detected top guide grid beam flaws to benchmark the accuracy of the flaw evaluation methodology. (3) When applying the flaw evaluation methodology in BWRVIP-183 Section 4, a severed beam evaluation consistent with BWRVIP-183 Section 5 will also be performed. The severed beam analysis will demonstrate that even if a beam was a completely severed beam, it would not be expected to interfere with the ability of the control rod drive system to insert control rods. e. Revise BWR Vessel Internals Program procedures to perform opportunistic inspections of the differential pressure and standby liquid control line inside the reactor vessel when the line becomes accessible.			
8	Enhance the Compressed Air Monitoring Program as follows: a. Revise Compressed Air Monitoring Program procedures to periodically sample, test, and monitor moisture and corrosive contaminants to verify parameters are within acceptable limits in the emergency diesel generator (EDG) starting air system to mitigate aging effects such as loss of material due to corrosion. b. Revise Compressed Air Monitoring Program procedures to include periodic and opportunistic inspections of accessible internal surfaces of piping, compressors, dryers, aftercoolers, and filters. In addition, include in the Compressed Air Monitoring Program procedures the applicable provisions recommended in EPRI NP-7079, EPRI TR- 108147, and ASME OM-S/G-1998, Part 17 for air system contaminants, inspection frequency, inspection methods, and acceptance	A.1.11	Prior to September 20, 2024.	LRA

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	criteria for components subject to aging management review that are exposed to compressed air and components in the EDG starting air system and control air system.			
9	Enhance the Containment Inservice Inspection (CII)-IWE Program as follows: a. Revise plant procedures to require inspection of the sand cushion drain lines to monitor the internal conditions of the drain lines (e.g., for moisture, sand, blockage) and ensure there is no evidence of blockage at least once prior to the period of extended operation and once every 10 years during the period of extended operation. b. Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and in EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high strength bolting. c. Revise plant procedures to include the preventive actions for storage of American Society for Testing and Materials (ASTM) A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts." d. [Deleted] e. [Deleted] f. Revise plant procedures to determine drywell shell thickness in the sand cushion areas before the period of extended operation and once in each 10-year interval during the period of extended operation. From the results (including prior results), develop a corrosion rate to demonstrate that the drywell shell will have sufficient wall thickness to perform its intended function through the period of extended operation. g. Revise plant procedures to require corrective actions should moisture be detected or suspected in the inaccessible area on the exterior of the drywell shell, including:	A.1.12	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA DTE letter NRC-15-0004 dated 1/15/15

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	• Identify surfaces requiring augmented inspections for the period of extended operation in accordance with Subsection IWE-1240, as identified in Table IWE-2500-1, Examination Category E-C. • Use examination methods that are in accordance with Subsection IWE-2500. • Demonstrate through use of augmented inspections performed in accordance with Subsection IWE that corrosion is not occurring or that corrosion is progressing so slowly that the degradation will not jeopardize the intended function of the drywell shell through the period of extended operation.			
10	Enhance Diesel Fuel Monitoring Program as follows: a. Revise Diesel Fuel Monitoring Program procedures to monitor and trend water and sediment, particulates, and levels of microbiological organisms in the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and CTG fuel oil tank quarterly. In addition, revise program procedures to state that biocides or corrosion inhibitors may be added as a preventive measure or are added if periodic testing indicates biological activity or evidence of corrosion, respectively. b. Revise the Diesel Fuel Monitoring Program procedures to include a 10-year periodic cleaning and internal visual inspection of the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel fire pump fuel oil tank, and CTG fuel oil tank with the following instructions. The cleanings and internal inspections will be performed at least once during the 10-year period prior to the period of extended operation and at succeeding 10-year intervals. If visual inspection is not possible, perform a volumetric inspection. If evidence of degradation is observed during visual inspection, perform a volumetric examination of the affected area.	A.1.14	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA DTE letter NRC-15-0056 dated 5/19/15

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	The schedule for the Preventive Maintenance (PM) event to perform diesel fire pump fuel oil tank draining, flushing, and inspection will continue at its frequency at the time of the enhancement implementation, until a PM evaluation of results from fuel oil samples and tank inspections indicates that the system will be capable of continuing to perform its function during the period of extended operation with a lower frequency, not less than once per 10-year interval for cleaning and internal visual inspection consistent with NUREG-1801.			
11	Enhance External Surfaces Monitoring Program as follows: a. Revise External Surfaces Monitoring Program procedures to clarify that periodic inspections will be performed of systems in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include structures, systems, and components (SSCs) that are in scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(2). b. Revise External Surfaces Monitoring Program procedures to inspect 100 percent of accessible components at least once per refueling cycle and to ensure required walk downs include instructions to inspect for the following related to metallic components: • Corrosion (loss of material). • Leakage from or onto external surfaces (loss of material). • Worn, flaking, or oxide-coated surfaces (loss of material). • Corrosion stains on thermal insulation (loss of material). • Protective coating degradation (cracking, flaking, and blistering). • Leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides (cracking).	A.1.16	Prior to September 20, 2024.	LRA DTE letter NRC-14-0051 dated 7/30/14 DTE letter NRC-15-0007 dated 1/28/15 DTE letter NRC-15-0032 dated 4/17/15 DTE letter NRC-15-0067 dated 6/18/15

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	c. Revise External Surfaces Monitoring Program procedures to include instructions for monitoring aging effects for flexible polymeric components through physical manipulations of the material, with a sample size for manipulation of at least 10 percent of the available surface area. Inspect accessible surfaces for the following: • Surface cracking, crazing, scuffing, dimensional changes (e.g., ballooning and necking). • Discoloration. • Exposure of internal reinforcement for reinforced elastomers. • Hardening as evidence by loss of suppleness during manipulation where the component and material are appropriate to manipulation. • Shrinkage, loss of strength. d. Revise External Surfaces Monitoring Program procedures to specify the following for insulated components: • Periodic representative inspections will be conducted during each 10-year period. • For a representative sample of insulated indoor components exposed to condensation (because the component is operated below the dew point) and insulated outdoor components, insulation will be removed for visual inspection of the component surface. Inspections include a minimum of 20 percent of the in-scope piping length for each material type (e.g., steel, stainless steel, copper alloy, aluminum), or for components with a configuration which does not conform to a 1-foot axial length determination (e.g., valve, accumulator), 20 percent of the surface area. Alternatively, insulation will be removed and a minimum of 25 inspections performed that can be a combination of 1-foot axial length sections and individual components for each material type.			

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	• Inspection locations are based on the likelihood of corrosion under insulation (CUI). For example, CUI is more likely for components experiencing alternate wetting and drying in environments where trace contaminants could be present and for components that operate for long periods of time below the dew point. Subsequent inspections will consist of an examination of the exterior surface of the insulation for indications of damage to the jacketing or protective outer layer of the insulation, if the following conditions are verified in the initial inspection: o No loss of material due to general, pitting or crevice corrosion, beyond that which could have been present during initial construction, and o No evidence of cracking. If the external visual inspections of the insulation reveal damage to the exterior surface of the insulation or there is evidence of water intrusion through the insulation (e.g., water seepage through insulation seams/joints), periodic inspections under the insulation will continue as described above. • Removal of tightly adhering insulation that is impermeable to moisture is not required unless there is evidence of damage to the moisture barrier. If the moisture barrier is intact, the likelihood of CUI is low for tightly adhering insulation. Tightly adhering insulation is considered to be a separate population from the remainder of insulation installed on in-scope components. The entire population of in-scope accessible piping component surfaces that have tightly adhering insulation will be visually inspected for damage to the moisture barrier with the same frequency as for other types of insulation inspections. These			

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	inspections will not be credited towards the inspection quantities for other types of insulation. e. Revise External Surfaces Monitoring Program procedures to include acceptance criteria for the parameters observed. • Metals should not have any indications of relevant degradation. • Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color. • Rigid polymers should have no erosion, cracking, crazing or chalking. • For insulation, no discoloration, staining, or surface irregularities from moisture intrusion. f. Revise External Surfaces Monitoring Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR Part 50 Appendix B Quality Assurance Program. g. Revise External Surfaces Monitoring Program procedures to include instructions for detection of cracking of gas-filled stainless steel and aluminum components exposed to outdoor air. h. Revise External Surfaces Monitoring Program procedures to: (a) Visually inspect jacketed and nonjacketed insulation required to reduce heat transfer at a frequency consistent with NUREG-1801 Section XI.M36, as modified by LR-ISG-2012-02, to ensure that insulation degradation due to moisture intrusion has not occurred. (b) Ensure procedures include instructions to inspect for signs of water intrusion. Inspect accessible surfaces for the following signs of water intrusion: discoloration, staining, or surface irregularities.			
12	Enhance the Fatigue Monitoring Program as follows: a. Revise Fatigue Monitoring Program procedures to monitor	A.1.17	Part (b): At least 2 years prior to March 20, 2025.	LRA

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	and track critical thermal and pressure transients for components that have been identified to have a fatigue TLAA. b. Develop environmentally assisted fatigue (EAF) usage calculations that consider the effects of the reactor water environment for a set of sample reactor coolant system components. This sample set will include the locations identified in NUREG/CR-6260 and additional plant-specific component locations in the reactor coolant pressure boundary if they are found to be more limiting than those considered in NUREG/CR-6260. Environmental correction factors will be determined using formulae consistent with those recommended in NUREG-1801, X.M1. c. Revise Fatigue Monitoring Program procedures to provide updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached, or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified. For components with assumed minimal cycle counts, ensure that exemption assumptions are not exceeded. d. After the EAF calculations are completed, revise the Fatigue Monitoring Program procedures to state that the program counting of the cycle limits maintains the cumulative fatigue usage below the design limit through the period of extended operation, with consideration of the reactor water environmental fatigue effects. Revise Fatigue Monitoring Program procedures to allow for use of cycle-based fatigue (CBF) or stress-based fatigue (SBF) monitoring methods (including environmental effects) if a component's cumulative usage factor (CUF) value is projected to exceed 1.0 after EAF calculations are completed. e. Revise Fatigue Monitoring Program procedures so that the scope of the program includes monitoring the operating		Remainder: Prior to September 20, 2024.	DTE letter NRC-15-0005 dated 1/20/15 DTE letter NRC-15-0011 dated 2/12/15

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	hours for the main steam bypass operation at the 30%-45% valve open position and perform trending to ensure that the operating time for the main steam bypass operation remains below the design limit during the period of extended operation. f. Revise Fatigue Monitoring Program procedures to provide for corrective actions to prevent the operating time for the main steam bypass from exceeding the analysis during the period of extended operation. Acceptable corrective actions include repair of the component, replacement of the component, or a more rigorous analysis of the component to demonstrate that the service life will not be exceeded during the period of extended operation.			
13	Enhance the Fire Protection Program as follows: a. Revise Fire Protection Program procedures to perform visual inspections to manage loss of material of the Halon and CO2 fire suppression system. b. Revise Fire Protection Program procedures to require visual inspections of in-scope: • Fire wrap and fire stop materials for loss of material, change in material properties, cracking/delamination, separation, increased hardness, shrinkage, and loss of strength. • Carbon steel penetration sleeves for loss of material. • Steel framing, roof decking, and floor decking for loss of material. • Concrete fire barriers including manways, manhole covers, handholes, and roof slabs for loss of material and cracking. • Railroad bay airlock doors for loss of material. Inspections are performed at a frequency in accordance with the NRC-approved fire protection program or at least once every refueling cycle.	A.1.18	Prior to September 20, 2024.	LRA DTE letter NRC-15-0009 dated 1/15/15

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Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
14	Enhance the Fire Water System Program as follows: a. Revise Fire Water System Program procedures to ensure sprinkler heads are tested or replaced in accordance with National Fire Protection Association (NFPA) 25 (2001 Edition), Section 5.3.1. b. Revise Fire Water System Program procedures to perform an inspection of wet fire water system piping condition at least once every 5 years by opening a flushing connection at the end of one main and by removing a sprinkler toward the end of one branch line for the purpose of inspecting the interior for evidence of loss of material and the presence of foreign organic or inorganic material that could result in flow obstructions or blockage of a sprinkler head. Where multiple wet-pipe systems are in a building, every other system shall be inspected in a 5-year period. Then, in the next 5-year period, the remaining systems in that building shall be inspected. (Refer to NFPA 25 (2011 Edition), Sections 14.2.1 and 14.2.2.) The inspection method used shall be capable of detecting surface irregularities that could indicate wall loss due to corrosion, corrosion product deposition, and flow blockage due to fouling. Ensure procedures require a followup volumetric wall thickness evaluation where irregularities are detected. c. Revise Fire Water System Program procedures to: (a) ensure sprinkler heads are tested or replaced in accordance with NFPA 25 (2011 Edition) Section 5.3.1 and (b) the fire protection engineer approves the sprinkler testing laboratory. d. Revise Fire Water System Program procedures to: (a) specify that in accordance with NFPA 13.2.5.2 when there is a 10 percent reduction in full flow pressure when compared to the original acceptance test or previously performed tests, the cause of the reduction shall be	A.1.19	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later, with the exception that the activities described in this commitment for piping segments designed to be dry but determined to be collecting water shall be conducted within 5 years prior to March 20, 2025.	LRA DTE letter NRC-14-0051 dated 7/30/14 DTE letter NRC-15-0002 dated 1/15/15 DTE letter NRC-15-0031 dated 4/10/15

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	identified and corrected as necessary; and (b) note the time to return to static pressure after performing a main drain test. e. Revise Fire Water System Program procedures to notify the fire protection engineer of test results and deficiencies identified or detected during testing. f. Revise Fire Water System Program procedures to ensure piping is cleaned and sprinklers are replaced if obstructions are identified during internal inspections. Sprinklers loaded with dust may be cleaned using air rather than replaced. g. Revise Fire Water System Program procedures to perform an internal inspection of wet fire water system piping conditions at least once every 5 years by opening a flushing connection at the end of one main and by removing a sprinkler toward the end of the branch line for the purpose of inspecting the interior for evidence of loss of material and the presence of foreign organic and inorganic material that could result in flow obstructions or blockage of sprinkler heads. Where multiple wet-pipe systems are in a building, every other system shall be inspected in a 5-year period. Then, in the next 5-year period, the remaining systems in that building shall be inspected. h. [Deleted] i. Revise Fire Water System Program procedures to perform at least once every 5 years either an internal inspection of the dry components downstream of the deluge valves for the hydrogen seal oil unit by removing a sprinkler toward the end of one branch line and inspecting for evidence of loss of material and the presence of foreign organic and inorganic material that could result in flow obstructions or blockage of sprinklers, or Revise Fire Water System Program procedures to perform at least once every 5 years an air or smoke test to verify there is			

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	no flow obstruction or blockage of sprinklers. j. Revise Fire Water System Program procedures to perform an inspection of the water distribution piping associated with charcoal filters for loss of material and foreign organic or inorganic material when the charcoal beds are replaced. k. Revise Fire Water System Program procedures to perform an obstruction investigation whenever any of the criteria listed in NFPA Section 14.2.1.3 or 14.3.1 are met. l. Perform a fire water system walkdown of the piping and components that are designed to be dry (e.g., downstream of deluge valves or manual isolations of dry fire water piping), but are periodically wetted, to determine if any piping sections are collecting water and are subject to both of the following augmented inspections: • In each 5-year interval, beginning 5 years prior to the period of extended operation, either (a) conduct a flow test or flush sufficient to detect potential flow blockage, or (b) conduct a visual inspection of 100 percent of the internal surface of piping segments that cannot be drained or piping segments that allow water to collect. • In each 5-year interval of the period of extended operation, inspect 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect using volumetric techniques to measure wall thickness. Measurement points will be obtained so that each potential degraded condition can be identified (e.g., general corrosion, microbiologically induced corrosion (MIC)). The 20 percent of piping that will be inspected in each 5-year interval will be in different locations than previously inspected piping. m. Revise Fire Water System Program procedures to include acceptance criteria that any indication of fouling is evaluated. n. Revise Fire Water System Program procedures to specify			

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	that if the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material is removed and the source and extent of condition determined, corrected, and the condition entered into the corrective action program. o. Revise Fire Water System Program procedures to replace sprinklers associated with representative tested sprinkler, if the representative test sprinkler fails to meet the test requirements. p. Revise Fire Water System Program procedures to replace any sprinkler that shows signs of corrosion. q. If the decreasing trend in fire water system flow tests is not resolved through the corrective action program prior to the period of extended operation, revise Fire Water System Program procedures to continue performing annual fire water system flow tests during the period of extended operation until such a time as trend data from fire water system flow tests indicates that the system will be capable of performing its intended function throughout the period of extended operation and, therefore, Technical Requirements Manual (TRM) frequency may be resumed. r. Revise Fire Water System Program procedures to include formal documentation of the Control Center Heating, Ventilation, and Air Conditioning (CCHVAC) makeup and recirculation fire water supply drain down inspection for indications of flow blockage.			
15	Enhance the Flow-Accelerated Corrosion Program as follows: a. Revise procedures to indicate that the Flow-Accelerated Corrosion Program also manages loss of material due to erosion mechanisms of cavitation, flashing, liquid droplet impingement, and solid particle erosion for any material in treated water or steam environments. Include in program procedures a susceptibility review based on internal operating experience, external operating experience, EPRI TR-1011231,	A.1.20	Prior to September 20, 2024.	LRA

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	and NUREG/CR-6031. Piping subject to erosive conditions is not excluded from inspections, even if it has been replaced with flow-accelerated corrosion-resistant material. Periodic wall thickness measurements of such piping should continue until the effectiveness of corrective actions is assured. b. Revise Flow-Accelerated Corrosion Program procedures to specify that downstream components are monitored closely for wall thinning when susceptible upstream components are replaced with resistant materials.			
16	Enhance the Inservice Inspection (ISI)-IWF Program as follows: a. Revise plant procedures to specify the preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting. b. Revise plant procedures to require structural bolting replacement and maintenance activities to include appropriate preload and proper tightening (torque or tension) as recommended in EPRI documents, ASTM standards, American Institute of Steel Construction (AISC) Specifications, as applicable. c. Revise plant procedures to include the preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts." d. Revise plant procedures to specify that detection of aging effects will include monitoring anchor bolts for loss of material, loose or missing nuts or bolts, and cracking of concrete around the anchor bolts. e. Revise plant procedures to identify the following unacceptable conditions: • Debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces as intended in the	A.1.22	Prior to September 20, 2024.	LRA DTE letter NRC-15-0032 dated 4/17/15 DTE letter NRC-15-0044 dated 4/27/15

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	design basis of the support. • Cracked or sheared bolts, including high-strength bolts, and anchors. f. Revise plant procedures to include the preventive action of using bolting material that has an actual measured yield strength less than 150 ksi, except in the case of like-for-like replacement of existing bolting material in the reactor pressure vessel skirt to ring girder bolted joint. g. Revise plant procedures to include assessment of the impact on the inspection sample, in terms of sample size and representativeness, if components that are part of the sample population are re-worked.			
17	Enhance the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (OVHLL) Program as follows: a. Revise plant procedures to specify the monitoring of rails in the rail system for loss of material due to wear; monitor structural components of the bridge, trolley and hoists for deformation, cracking, and loss of material due to corrosion; and monitor structural connections/bolting for loose or missing bolts, nuts, pins, or rivets, and any other conditions indicative of loss of bolting integrity. b. Revise plant procedures to specify inspection frequency requirements will be in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series. c. Revise plant procedures to require that significant loss of material due to wear of rails in the rail system and any sign of loss of bolting integrity will be evaluated in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series. d. Revise plant procedures to specify that maintenance and repair activities will use the guidance provided in ASME B30.2 or other appropriate standard in the ASME B30 series.	A.1.23	Prior to September 20, 2024.	LRA
18	Implement the new Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage fouling, cracking, loss of	A.1.24	Prior to September 20, 2024.	LRA

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	material, and change in material properties using representative sampling and opportunistic visual inspections of the internal surfaces of piping and components in environments other than open-cycle cooling water, closed treated water, and fire water. Program periodic surveillances or maintenance activities will be conducted when the surfaces are accessible for visual inspection.			
19	Implement the new Metal Enclosed Bus Inspection Program to provide for the inspection of the internal and external portions of metal enclosed bus to identify age-related degradation of the bus and bus connections, the bus enclosure assemblies, the bus insulation and the bus insulators.	A.1.26	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA
20	Enhance Neutron-Absorbing Material Monitoring Program as follows: a. Prior to the period of extended operation, revise Neutron-Absorbing Material Monitoring Program procedures to establish an inspection frequency, justified with plant-specific operating experience, of at least once every 10 years, based on the condition of the neutron-absorbing material. b. Revise Neutron-Absorbing Material Monitoring Program procedures to perform trending of coupon testing results to determine the rate of degradation. Ensure the predicted boron-10 areal density will be sufficient to maintain the subcritical conditions required by technical specifications until the next coupon test.	A.1.27	Prior to September 20, 2024.	LRA
21	Implement the new Non-EQ Cable Connections Program, a one-time inspection program that consists of a representative sample of electrical connections within the scope of license renewal, which is inspected or tested at least once prior to the period of extended operation to confirm that there are no aging effects requiring management during that period. Cable connections included in this program are those connections susceptible to age-related degradation resulting in in-creased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation that are not subject to the environmental qualification requirements of 10 CFR 50.49.	A.1.28	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA

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22	Implement the new Non-EQ Inaccessible Power Cables (400 V to 13.8 kV) Program, a condition monitoring program that will manage the aging effect of reduced insulation resistance on inaccessible power (400 V to 13.8 kV) cables that have a license renewal intended function. The program calls for inaccessible or underground (e.g., in conduit, duct bank, or direct buried) power (greater than or equal to 400 V) cables exposed to significant moisture, to be tested at least once every 6 years to provide an indication of the condition of the conductor insulation, with the first tests occurring before the period of extended operation. The program will include periodic inspections for water accumulation in manholes within the scope of this program.	A.1.29	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA

23	Implement the new Non-EQ Instrumentation Circuits Test Review Program, a performance monitoring program that will manage the aging effects of applicable cables in the following systems or sub-systems.
	• Neutron monitoring
	  - Intermediate range channels (IRM)
	  - Average power range monitors (includes local power range monitors [LPRM] detector strings)
	• Process radiation monitoring
	  - Control center emergency air inlet radiation monitors
	  - Fuel pool ventilation exhaust radiation monitors
	  - Main steam line radiation monitors
	The Non-EQ Instrumentation Circuits Test Review Program calls for the review of calibration results or findings of surveillance tests on electrical cables and connections used in circuits with sensitive, high-voltage, low-level current signals, such as radiation monitoring and nuclear instrumentation, to provide an indication of the existence of aging effects based on acceptance criteria related to instrumentation circuit performance. The review of calibration results or findings of surveillance tests is performed at least once every 10 years. In cases where cables are not included as part of calibration or surveillance program testing circuit, a proven cable test (such as insulation resistance tests, time domain reflectometry tests, or other testing judged to be effective in determining cable system insulation condition as justified in the application) is
		A.1.30	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA

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	performed. The test frequency is based on engineering evaluation and is at least once every 10 years.			
24	Implement the new Non-EQ Insulated Cables and Connections Program, a condition monitoring program that provides reasonable assurance that the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation, moisture, and chemical contamination (i.e., bird droppings) can be maintained consistent with the current licensing basis through the period of extended operation. The program consists of accessible insulated electrical cables and connections installed in adverse localized environments to be visually inspected at least once every 10 years.	A.1.31	Prior to September 20, 2024, or the end of the last refueling outage prior to March 20, 2025, whichever is later.	LRA DTE letter NRC-15-0056 dated 5/19/15
25	Enhance the Oil Analysis Program as follows: a. Revise Oil Analysis Program procedures to identify components within the scope of the program. b. Revise Oil Analysis Program procedures to provide a formalized analysis technique for particulate counting. c. Revise Oil Analysis Program procedures to include the sampling and testing requirements of equipment manufacturers or industry standards.	A.1.32	Prior to September 20, 2024.	LRA
26	Implement the new One-Time Inspection Program that will consist of a one-time inspection of selected components to accomplish the following: • Verify the effectiveness of an aging management program that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. The aging effects evaluated are loss of material, cracking, and fouling. • Confirm the insignificance of an aging effect for situations in which additional confirmation is appropriate using inspections that verify degradation is not occurring. • Trigger additional actions that ensure the intended functions of affected components are maintained during the period of extended operation.	A.1.33	Inspections will be performed within the 10 years prior to March 20, 2025.	LRA

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27	Implement the new One-Time Inspection – Small-Bore Piping Program that will augment ASME Code, Section XI (2001 Edition with 2003 Addenda) requirements and be applicable to small-bore ASME Code Class 1 piping and components with a nominal pipe size diameter less than 4 inches (NPS 4) and greater than or equal to 1 inch (NPS 1) in systems that have not experienced cracking of ASME Code Class 1 small-bore piping.	A.1.34	The inspection will be performed within the 6-year period prior to March 20, 2025.	LRA
28	Enhance the Periodic Surveillance and Preventive Maintenance Program as follows: a. Revise the Periodic Surveillance and Preventive Maintenance Program procedures as necessary to incorporate the identified activities in LRA Section A.1.35. b. Revise the Periodic Surveillance and Preventive Maintenance Program procedures to state that acceptance criterion is no indication of relevant degradation and to incorporate the following: • Examples of acceptance criteria for metallic components - No excessive corrosion (loss of material) - No leakage from or onto internal surfaces (loss of material) - No excessive wear (loss of material) - No flow blockage due to fouling - No loss of piping component structural integrity • Examples of acceptance criteria for elastomeric components - Flexible polymers should have a uniform surface texture and color with no cracks and no dimension change, no abnormal surface conditions with respect to hardness, flexibility, physical dimensions, and color. c. Revise Periodic Surveillance and Preventive Maintenance Program procedures to require periodic determination of wall thickness for selected piping components. d. Revise Periodic Surveillance and Preventive Maintenance	A.1.35	Prior to September 20, 2024. Initial inspection of cable spreading room dry piping will be performed within the 5 years prior to March 20, 2025.	LRA DTE letter NRC-14-0051 dated 7/30/14 DTE letter NRC-15-0002 dated 1/15/15

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	Program procedures to require wall thickness measurements using ultrasonic testing (UT) or other suitable techniques at selected locations to be periodically performed to identify loss of material due to multiple corrosion mechanisms (MCM) in system piping components. The selected locations are based on pipe configuration, flow conditions, and operating history to represent a cross-section of potential MCM sites. The selected locations are periodically reviewed to validate their relevance and usefulness, and are modified accordingly. Prior to the period of extended operation, select a method (or methods) from available technologies for inspecting internal surfaces of buried piping that provide(s) suitable indication of piping wall thickness for a representative set of buried piping locations. e. Revise Periodic Surveillance and Preventive Maintenance Program procedures to compare wall thickness measurements to nominal wall thickness or previous measurements to determine rates of corrosion degradation. Compare wall thickness measurements to code minimum wall thickness plus margin for corrosion during the refueling cycle (Tmarg) to determine acceptability of the component for continued use. Perform subsequent wall thickness measurements as needed for each selected location based on the rate of corrosion and expected time to reach Tmarg. Perform a minimum of five MCM degradation inspections per year until the rate of MCM corrosion occurrences no longer meets the criteria for recurring internal corrosion.			
29	Enhance the Protective Coating Monitoring and Maintenance Program as follows: a. Revise plant procedures to include in the program Service Level I coating applied to steel and concrete surfaces of the steel containment vessel (e.g., steel containment vessel shell, structural steel, supports, penetrations, and concrete walls and floors).	A.1.36	Prior to September 20, 2024	LRA

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	b. Revise plant procedures to include information and instructions for monitoring Service Level I coating systems to be used for the inspection of coatings in accordance with guidelines identified in ASTM D5163-08. c. Revise plant procedures to specify the parameters monitored or inspected in accordance with subparagraph 10.2 of ASTM D5163-08. d. Revise plant procedures to establish the inspection frequency in accordance with paragraph 6 of ASTM D5163-08. e. Revise plant procedures to develop an inspection plan and specify inspection methods to be used as identified in accordance with subparagraph 10.1 of ASTM D5163-08. f. Revise plant procedures to specify that the nuclear coating specialist qualification recommendations and duties be as defined in ASTM D7108. As a minimum, qualification of inspection personnel (protective coating surveillance personnel) who perform these inspections shall be as specified in ASTM D4537. g. Revise plant procedures to specify a protective coatings program owner (inspection coordinator and inspection results evaluator) or equivalent to nuclear coating specialist defined in ASTM D5163-08, is responsible for the overall plant coatings program and has general duties and responsibilities similar to those defined for a nuclear coating specialist in Section 5 of ASTM D7108-05. h. Revise plant procedures to specify that detection of aging effects will include visual inspections of coatings near sumps or screens associated with the ECCS. i. Revise plant procedures to specify instruments and equipment needed for inspection in accordance with subparagraph 10.5 of ASTM D5163- 08. j. Revise plant procedures to specify that upon the completion of a planned refuel outage, a coatings outage summary report will be prepared of the coating work			

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	performed in Service Level I areas during the outage. The summary report prioritizes repair areas as areas that must be repaired during the same outage or postponed to future outages, keeping the coatings under surveillance during the interim period. k. Revise plant procedures to specify that the last two performance monitoring reports pertaining to the coating systems will be reviewed prior to the inspection or monitoring process. l. Revise plant procedures to describe the characterization, documentation, and testing of defective or deficient coating surface in accordance with subparagraphs 10.2.1 through 10.2.6, 10.3, and10.4 of ASTM D5163-08. m. Revise plant procedures to specify that the coatings outage summary report will be evaluated and approved by the protective coatings program owner.			
30	Enhance the Reactor Head Closure Studs Program as follows: a. Revise Reactor Head Closure Studs Program procedures to ensure that replacement studs are fabricated from bolting material with actual measured yield strength of less than 150 kilopounds per square inch (ksi). b. Revise Reactor Head Closure Studs Program procedures to include a statement that excludes the use of molybdenum disulfide (MoS_2) on the reactor vessel closure studs and also refers to recommendations in Regulatory Guide 1.65, Rev. 1.	A.1.37	Prior to September 20, 2024.	LRA
31	[Deleted]			LRA DTE letter NRC-15-0020 dated 3/5/15
32	Implement the new Selective Leaching Program that will demonstrate the absence of selective leaching in a selected sample of components (i.e., 20 percent of the population with maximum of 25 components)	A.1.40	Inspection will be performed within 5 years prior to March 20, 2025.	LRA

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	fabricated from gray cast iron and copper alloys (except for inhibited brass) that contain greater than 15 percent zinc or greater than 8 percent aluminum exposed to raw water, treated water, waste water, or soil.			
33	Enhance the Service Water Integrity Program as follows: a. Revise Service Water Integrity Program procedures to include inspection to determine if loss of material due to erosion is occurring in the system. b. Revise Service Water Integrity Program procedures to stipulate that administrative controls are in accordance with the Fermi 2 10 CFR Part 50 Appendix B Quality Assurance Program.	A.1.41	Prior to September 20, 2024.	LRA
34	Enhance the Structures Monitoring Program as follows: a. Revise plant procedures to add the following structures to the program. • CST and condensate return tank foundations and retaining barrier • CTG-11-1 fuel oil storage tank foundation • Independent spent fuel storage installation (ISFSI) rail transfer pad • Manholes, handholes, and duct banks • Shore barrier • Transformer and switchyard support structures and foundations b. Revise plant procedures to specify that the following in-scope structures are included in the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program (Section A.1.39): • General service water pump house • Residual heat removal complex • Shore barrier c. Revise plant procedures to ensure that masonry walls located in in-scope structures are in the scope of the Masonry Wall Program (Section A.1.25). d. Revise plant procedures to include a list of structural	A.1.42	Prior to September 20, 2024. Testing and evaluation for possible leaching in previously identified conditions will commence in 2015.	LRA DTE letter NRC-14-0070 dated 10/24/14 DTE letter NRC-14-0082 dated 12/26/14 DTE letter NRC-15-0008 dated 1/26/15 DTE letter NRC-15-0030 dated 3/19/15

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	components and commodities within the scope of license renewal to be monitored in the program. e. Revise plant procedures to include periodic sampling and chemical analysis of groundwater. f. Revise plant procedures to include the following preventive actions: • Preventive actions delineated in NUREG-1339 and EPRI NP-5769, NP-5067, and TR-104213 that emphasize the proper selection of bolting material, installation torque or tension, and the use of lubricants and sealants for high-strength bolting. • Preventive actions for storage of ASTM A325 and A490 bolting from Section 2 of Research Council for Structural Connections publication, “Specification for Structural Joints Using ASTM A325 or A490 Bolts.” g. Revise plant procedures to include the following parameters to be monitored or inspected: • For concrete structures, base inspections on quantitative requirements of industry codes (i.e., American Concrete Institute (ACI) 349.3R-02), standards and guidelines (i.e., American Society of Civil Engineers (ASCE) 11) and consideration of industry and plant-specific operating experience. • For concrete structures and components, include loss of material, loss of bond, increase in porosity and permeability, loss of strength, and reduction in concrete anchor capacity due to local concrete degradation. • For chemical analysis of groundwater, monitor pH, chlorides, and sulfates. • Monitor gaps between the structural steel supports and masonry walls that could potentially affect wall qualification. h. Revise plant procedures to include the following components to be monitored for the associated parameters: • Structural bolting and anchors/fasteners (nuts and bolts) for loss of material, loose or missing nuts			

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Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	and/or bolts, and cracking of concrete around the anchor bolts. • Elastomeric vibration isolators and structural sealants for cracking, loss of material, loss of sealing, and change in material properties (e.g., hardening). i. Revise plant procedures to provide technical guidance for torque value requirements for specified bolting material subject to plant operating environments. j. Revise plant procedures to include the following for detection of aging effects: • Personnel (Inspection Engineer and Program Administrator or Responsible Engineer) involved with the inspection and evaluation of structures and structural components, including masonry walls and water-control structures, meet the qualifications guidance identified in ACI 349.3R-02. • Visual inspection of elastomeric material should be supplemented by feel or touch to detect hardening if performance of the intended function of the elastomeric material is suspect. Include instructions to augment the visual examination of elastomeric material with physical manipulation of at least 10 percent of available surface area. • Structures will be inspected at least once every 5 years. • Submerged structures will be inspected at least once every 5 years. • If normally inaccessible areas become accessible due to plant activities, an inspection of these areas shall be conducted. Additionally, inspections will be performed of inaccessible areas in environments where observed conditions in accessible areas indicate that significant degradation may be occurring in the inaccessible areas. • Sampling and chemical analysis of groundwater at least once every 5 years. The Structures			

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Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	Monitoring Program owner will review the results and evaluate any anomalies and perform trending of the results. • Masonry walls will be inspected at least once every 5 years, with provisions for more frequent inspections in areas where significant aging effects (e.g., missing blocks, cracking) is observed to ensure there is no loss of intended function between inspections. • Inspection of water-control structures should be conducted under the direction of qualified personnel experienced in the investigation, design, construction, and operation of these types of facilities. • Inspections of water-control structures on an interval not to exceed 5 years. • Perform special inspections of water-control structures immediately (within 30 days) following the occurrence of significant natural phenomena, such as large floods, earthquakes, hurricanes, tornadoes, and intense local rainfalls. k. Revise plant procedures to prescribe quantitative acceptance criteria based on the quantitative acceptance criteria of ACI 349.3R-02 and information provided in industry codes, standards, and guidelines including ACI 318, American National Standards Institute (ANSI)/ASCE 11, and relevant AISC specifications. Industry and plant-specific operating experience will also be considered in the development of the acceptance criteria. l. Revise plant procedures to include acceptance criteria for masonry wall inspections that ensure observed aging effects (cracking, loss of material or gaps between the structural steel supports and masonry walls) do not invalidate the wall's evaluation basis or impact its intended function. m. Revise Structures Monitoring Program procedures to include testing and evaluation of water/mineral deposits			

TABLE B-1 Fermi 2 License Renewal Commitments

Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	where in-leakage is observed in concrete elements. Testing and evaluation will determine whether leaching of calcium hydroxide and carbonation are occurring that could impact the intended function(s) of the concrete structure. n. The following testing and evaluation will be performed prior to the period of extended operation to confirm that previously identified conditions are not the result of leaching of calcium hydroxide and carbonation that could impact the intended function(s) of the concrete structure. • Available water/mineral deposit samples will be tested for mineral and iron content to assess the effect of the water in-leakage on the reinforced concrete elements involved. • The results of the testing and Structures Monitoring Program inspections will be used to determine corrective actions per the corrective action program. Possible corrective actions include, but are not limited to, more frequent inspections, sampling and analysis of the in-leakage water for mineral and iron content, testing core bore samples, and evaluation of the affected area using evaluation and acceptance criteria of ACI 349.3R-02.			
35	Enhance the Water Chemistry Control – Closed Treated Water Systems Program as follows: a. Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to include the following systems. • Process sampling system sample cooler loops • CCHVAC chill water system b. Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to provide chemical treatment, including a corrosion inhibitor for the following systems in accordance with industry guidelines and vendor	A.1.44	Prior to September 20, 2024.	LRA DTE letter NRC-15-0030 dated 3/19/15

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Item Number	Commitment	FSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
	recommendations. • Process sampling system sample cooler loops • CCHVAC chill water system c. Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to specify water chemistry parameters monitored and the acceptable range of values for these parameters in accordance with EPRI 1007820, industry guidance, or vendor recommendations. d. Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to inspect accessible components whenever a closed treated water system boundary is opened. Ensure that a representative sample of piping and components is inspected at a frequency of at least once every 10 years. These inspections will be conducted in accordance with applicable ASME Code requirements, industry standards, or other plant-specific inspection guidance by qualified personnel using procedures that are capable of detecting corrosion, fouling, or cracking. If visual examination identifies adverse conditions, then additional examinations, including UT, are conducted. Components inspected will be those with the highest likelihood of corrosion, fouling, or cracking. A representative sample is 20 percent of the population (defined as components having the same material, environment, and aging effect combination) with a maximum of 25 components. Perform treated water sampling and analysis of the closed treated water systems per industry standards and in no case greater than quarterly unless justified with an additional analysis. The process sampling system sample cooler loops will be sampled and tested annually.			
36	Implement the Coating Integrity Program as described in LRA Section B.1.45.	A.1.45	Prior to September 20, 2024, or the end of the last refueling outage prior to	DTE letter NRC-15-0021 dated 2/5/15

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			March 20, 2025, whichever is later. Initial inspections will be performed within the 10 years prior to March 20, 2025.	
37	Enhance the BWR CRD Return Line Nozzle Program as follows: a. Revise BWR CRD Return Line Nozzle Program procedures as necessary to ensure that UT examinations will be used to detect applicable aging effects.	A.1.5	Prior to September 20, 2024 or the end of the last refueling outage prior to March 20, 2025, whichever is later.	DTE letter NRC-15-0056 dated 5/19/15